Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

Studies Plan

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1st Year

	CH	ECTS		CH	ECTS
Mathematical Analysis I	5	6	Mathematical Analysis II	5	6
Linear Algebra	4	5	Electrical Circuits	5	6
General Physics	4	6	Circuits Tech., Simul. and Test	4	5
Programming	4	5	Probabilities and Statistics	4	5
Maritime Technology	4	4	Industrial Chemistry	4	5
English	3	4	Maritime Technical English	2	3
Total	**24**	**30**	Total	**24**	**30**

2nd Year

	CH	ECTS		CH	ECTS
Applied Mechanics	4	5	Marine Machines	4	5
Thermodynamics	4	5	Electrical Instalations	4	5
Electrical Machines and Drives	4	5	Computers Networks	4	5
Electronics I	4	5	Electronics II	4	5
Digital Systems	4	5	Industrial Instrumentation	4	5
Data Transmission	4	5	Power Electronics	4	5
Total	**24**	**30**	Total	**23**	**30**

3rd Year

	CH	ECTS		CH	ECTS
Auxiliar Systems	4	5	Electrial Equip. Maintenance	4	6
Navegation and Comm Systems	5	5	Electrical Propultion Systems	4	6
Control Systems	4	6	Marine Automation	5	6
Microcontrollers	4	5	Maritime Safety II	5	5
Maritime Safety I	4	4	Psicossociology	2	4
Instalações de Alta Tensão	4	5	Health Care	2	3
Total	**25**	**30**	Total	**24**	**30**

Legend:
HC: Contact Hours per week;
ECTS: European Credits Transfer and Accumulation System

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Maritime Certification
(STCW as amended in 2010)

The Completion of this degree allows to obtain the relevant certificates of competence and the following qualification certificates and documentary evidence, according the Amendments to the STCW Convention as amended in 2010, considering that are satisfied the remaining requirements for the issue of the certificate:

a) ***ADVANCED TRAINING IN FIRE FIGHTING****, in compliance with the contents of paragraphs 1st to 3th of section A-VI/3 (table A-VI/3).*

b) ***MEDICAL FIRST AID****, in compliance with the contents of paragraphs 1st to 3th of section A-VI/4 (table A-VI/4-1).*

c) ***BASIC SAFETY****, in compliance with the contents of paragraph 2th of section A-VI/1 (tables A-VI/1-1; A-VI/1-2; A-VI/1-3; A-VI/1-4).*

d) ***PROFICIENCY IN SURVIVAL CRAFT AND RESCUE BOATS (OTHER THAN FAST RESCUE BOATS)****, in compliance with the contents of paragraphs 1st to 4th of section A-VI/2-1 (table A-VI/2-1).*

e) ***PROFICIENCY FAST RESCUE BOAT****, in compliance with the contents of paragraphs 7th to 10th of section A-VI/2-2 (table A-VI/2-2).*

f) ***BASIC TRAINING FOR OIL AND CHEMICAL TANKERS****, in compliance with the contents of paragraph 1 in section A-V/1-1 (table A-V/1-1-1).*

g) ***BASIC TRAINING FOR LIQUEFIED GAS TANKERS****, in compliance with the contents of paragraph 1 in section A-V/1-2 (table A-V/1-2-1).*

h) ***CROWD MANAGEMENT****, in compliance with the contents of paragraph 1 in section A-V/2.*

i) ***SECURITY TRAINING FOR SEAFARERS WITH DESIGNATED SECURITY DUTIES****, in compliance with the contents of paragraphs 4 and 6 in Section A-VI/6, and tables A-VI/6-1 and A-VI/6-2.*

j) ***SAFETY TRAINING FOR PERSONNEL PROVIDING DIRECT SERVICE TO PASSENGERS****, in compliance with the contents of paragraph 2nd of section A-V/2.*

k) **ENGINE ROOM RESOURCE MANAGEMENT (ERM)**, in compliance with the contentes in section A-III /6 (table A-III/6).

l) **OPERATION, MAINTENANCE AND REPAIR OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS OF VARIOUS TYPES**, in compliance with the contentes in section A-III /6 (table A-III/6).

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m) **OPERATION AND MAINTENANCE OF ELECTRICAL SYSTEMS OVER 1000 V**, in compliance with the contentes in section A-III /6 (table A-III/6).

n) ***VHF RADIOTELEPHONY OPERATOR CLASS / A**, according to regulation whithin section VI, from Decree-Law no. 280 / 2001, dated 23rd October, and according to Radio Regulations from ITU – RR / UIT.*

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Individual Course Units Syllabus

1st year of studies – 1st semester

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Description of individual course unit

Course title:	**Mathematics I**		
Field:	Mathematics		
Course code:	923001	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	1º
ECTS:	6	**Hours/week:**	75 h TP
Name of lecturer:	João Nuno Garcia Nobre Prata		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

This curricular unit aims at consolidating the mathematical skills acquired during the secondary education and at providing new concepts and techniques in the field of mathematical analysis.
After successfully completing this course, students should master the main techniques of differential and integral calculus of one real variable.
This knowledge allows the construction of mathematical models for physical problems addressed in engineering and the simulation of the cases studied.

Course contents:

1. Succession and series
1.1. Definitions and basic notions on succession
1.2 Successions
1.3 Geometric series
1.4. Algebraic properties ofthe series
1.5. Convergence criteria forseries offixed signal
1.6. Alternating series
1.7. Powerseries
1.8. Intervalofconvergence forpowerseries
2. Real function of real variable
2.1. Realnumbers andtopologicalnotions.
2.2. Definition andbasic concepts ofrealfunctions ofrealvariable.
2.3. Graph functions, systems ofrectangularandpolarcoordinates.
2.4. Limits offunctions.
2.5. Conceptanddefinition ofthe derivative.
2.6. Derivation rules.
2.7. Derivative ofcomposite function, chain rule.
2.8. Derivative ofinverse function.
2.9. Applications ofderivatives.
2.10. Rolle's theorem, Lagrange andCauchy. Cauchy rule.
2.11. Taylor's formula. Approximations. Taylorseries.
3. Integral calculus
3.1. Definition of primitive. Early immediate
3.2. Rational function primitives: partial functions decomposition
3.4. Definite integral

Recommended reading:

Análise Matemática I – Apontamentos de apoio à disciplina, Luís Cruz-Filipe & Patrícia Engrácia, ENIDH.
Introdução à Análise Matemática - J. Campos Ferreira, Ed. Calouste Gulbenkian.
Calculus, Vol. 1,2 – T. M. Apostol, Wiley International Edition.

Teaching methods:

The goal of the course unit Calculus I is to develop the student ability to use mathematical reasoning, mainly using differential and integral calculus in the real numbers. This kind of reasoning give them tools to construct one dimensional mathematical models to solve problems occurring in Engineering. Thus, the syllabus includes an introductory section about sequences and series, and then it is generalized to the notion of function, which is then studied at the level of differential and integral calculus. Classroom theory with exposure of the syllabus and practical classes with problem solving. Aiming to enable students both to analyze and how to solve problems concerning the matters studied, the work required in this course develops, articulately, on two levels: theoretical and practical. For each of the chapters presented in lectures, designed book marks of exercises to be solved in practical classes. Besides these sheets, regular exercises are suggestedto be made athome and which should be discussed in groups.
Assessment methods:
1-Continuous assessment: two 90 minutes tests, each with a minimum score of 7/20 points. The final grade is the average of the grades in the two tests. 2-First exam date: 1 exam for those students who failed in the continuous assessment. 3-Second exam date: 1 exam for those students who failed in the previous assessment dates or those students who want to improve their grades.

Language of instruction:	Portuguese / English

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Description of individual course unit

Course title:	**Linear Algebra**		
Field:	Mathematics		
Course code:	923002	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Nuno Costa Dias		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Understanding and applying basic concepts of Linear Algebra necessary to other courses. Solving systems of linear equations by means of Gauss's Elimination Method, as well as problems leading to such systems. Mastering algebraic operations on matrices and calculus of determinants. Working with linear spaces and linear transformations and applying the learned techniques to problem solving in engineering. Solving optimization and approximation problems by means of computing orthogonal projections.

Course contents:

1. Linear spaces
Vector spaces as generalization of IRn. Examples and properties. Vector subspaces. Linear independence. Bases and dimension. Coordinated vectors, changes of base. Euclidean spaces: inner product, norm, orthogonality, Gram-Schmidt method. Orthogonal complements and projections. Applications.

2. Linear transformations
Definition, properties and examples. Algebraic operations and composition. Kernel. Matrix representation. Relationship between the properties of a transformation and the properties of the matrices representing it. Change of base. Eigenvectors, eigenvalues and diagonalization.

3. Real matrices
Basic definitions. Space of the lines, space of the columns, kernel. Characteristic of an array. Product of matrices. Inverse of a matrix. Determinants. Definition and generalities. Sarrus rule. Characterization of invertible matrices.

4. Systems of linear equations
Generalities. Resolution of systems of linear equations. Gaussian method. Equivalent systems. Examples. Geometric interpretation and applications.

Recommended reading:

Notes on Linear Algebra provided by the teacher.
Elementary Linear Algebra. H. Anton & C. Rorres, John Wiley, 2000.
Algebra Linear. Luis T. Magalhães. Texto Editora, 1996.

Teaching methods:

Theoretical-practical classes, including a theoretical exposition of each of the topics covered, practical examples of application and resolution of exercises. As a complement, a homework assignment is scheduled weekly.

Assessment methods:

1. Continuous assessment, including:

(a) 2 tests, carried out during the semester, lasting 1 hour each, and graded from 0 to 20. The minimum grade on each test is 7. Each missed test has a score of 0 (zero). The simple arithmetic average of the two test scores

is calculated (MT). If the classification in one of the tests is less then 7, MT = 0. (b) The grade of homework assignments and class participation (C) with a maximum value of 2. (c) The student will pass the course whenever 0.9 * MT + C> = 9.5, the final grade being calculated by (0.9 * MT + C) and rounded to the nearest integer. 1. Final Exam: final exam on the whole subject, lasting 2 hours, graded from 0 to 20 (E). To pass the course, the student must have E> = 9.5, the final grade being the value of E rounded to the nearest integer.	
Language of instruction:	Portuguese / English

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Description of individual course unit

Course title:	**Physics**		
Field:	Applied Mehcanics		
Course code:	923003	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	1º
ECTS:	6	**Hours/week:**	60 h TP
Name of lecturer:	Victor Franco Correia		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The primary objective of the course is to provide the student with a clear and logical presentation of the Basic concepts and principles of physics. Understand the concepts and principles through a broad range of real world applications. The student is motivated by practical examples that demonstrate the role of physics in other engineering subjects.

Course contents:

1 – Physics and Measurements (12 hours)
- What is physics science?
- Length, mass and time.
- Vector calculus introduction
- Motion in one dimension
- Motion in two dimensions

2 – Applied Mechanics (16 hours)
- Laws of Motion. Newton's Laws.
- Energy and Energy Transfer.
- Potential Energy.
- Linear Momentum and Collisions.
- Angular Position, Velocity, and Acceleration.
- Angular Momentum. Vector Product and Torque. Conservation of Angular Momentum.
- Static Equilibrium. Conditions for Equilibrium.

3 – Thermodynamics (10 hours)
- Temperature and Thermal Equilibrium.
- Thermal Expansion of Solids and Liquids.
- Heat and Internal Energy. First Law of Thermodynamics.
- Boltzmann constant and the Boyle's, Charles's and Gay-Lussac's laws.

4 – Electromagnetism (22 hours)
- Electric Fields. Coulomb's Law. Potential Difference and Electric Potential.
- Capacitance and Dielectrics.
- Current and Resistance. Electric Current.
- Magnetic Fields. Magnetic Forces.
- Sources of the Magnetic Field. The Magnetic Field. Magnetic Flux.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.2.1 BASIC KNOWLEDGE OF HEAT TRANSMISSION – (4/14 hours)

Recommended reading:

Serway R. and Jewett, Physics for Scientists and Engineers, Thomson, 6th ed.
Apontamentos do docente da disciplina

Teaching methods:

To initiate students in the study of the course of General Physics, topics are introduced about units and measurements of physical quantities, vector calculus and equations that describe the motion of a particle or

object. Then we study the laws of motion, energy and energy transfers, laws of conservation of energy, linear momentum, laws of thermodynamics, electric and magnetic field, complementing the theory with examples applied to the "real world" and models used at the several areas of engineering, using case studies and practical examples. This study is done using theoretical and practical exercises, such as determining the equations of motion of a particle, the calculation of the electric field, given a spatial distribution of charge, the determination of thermodynamic properties of a system, given the initial conditions, conditions of equilibrium, study of conservative and non-conservative forces, or elastic and inelastic collisions. Lectures and practical exercises are comprised to achieve the course objectives. Each subject will be Introduced and be followed by exercises. Various mechanisms will be used to help us all achieve these goals and to evaluate our levels of success. In order to enable students to understand and assimilate both the theoretical bases of the program, and to have an awareness of the application of these bases to the "real world," the teacher make a theoretical approach for each new topic, followed by a presentation of a series of theoretical and practical exercises, which are solved by the teacher in class. Students are encouraged to participate in solving this example exercises and to solve another set of exercises outside the classroom using literature, research and support given by the teacher outside the classroom.
Assessment methods:
Continuous evaluation composed by two tests with the minimum assessmentof 7 units in each and the arithmetic mean of 9,5 units in 0 – 20 scale;

Language of instruction:	Portuguese / English

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Description of individual course unit

Course title:	**Programming**		
Field:	Computers and Digital Systems		
Course code:	923004	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Luis Manuel Fernandes Mendonça		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

GENERAL GOAL:

Making students able to view computing solutions for problems by building programs in high-level language structured in a clear and objective perspective programming as well as their use in the workplace.

SPECIFIC OBJECTIVES:
Familiarize the student with the consecutive model of computation and algorithms;
Introduce basic concepts of structured programming languages and their basic functions as well as decision instruction and repetition;
Train the student in the use of high-level language in order to develop a structured programs, using algorithms, defined by;
Train students in the basic process of software development (design, editing, running and software testing).

Course contents:

Basic architecture of a computer (2.5 hours)

Introduction to algorithms and programming techniques historical introduction about programming; high-level and low level languages. The programming and problem solving. Program development phases. Application examples. (2.5 hours)

Algorithms; basics algorithms; arithmetic and logical expressions; following structures of repetition and selection; Algorithms implementation; Flowcharts. Programming control arrangements. Application examples. (15 hours)

Introduction to structured programming in C language (20 hours)

History of C; Structure of a program; Fundamentals of C; Operators and expressions of C; Functions and routines; Basic instruction in C; Developing a program in C applied to engineering problems.

Programming in Matlab environment. (20 hours)

The work environment; variables; Routines and functions; Simulation of dynamic systems;
Development of a program in Matlab applied to engineering problems.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.5.1.1 Main Features of Data Processing – (20/45 hours)

Recommended reading:

Gottfried, Byron S., Programando em C, 1993, McGraw-Hill (cota143/17)
Herbert Schildt, 1988, Turbo C- Guia do Usuário, McGraw-Hill
SCHILDT, Herbert, 1990, "C" Completo e Total. Editora McGraw-Hill
David McMahon, Matlab demystified, a self-teaching guide, McGrawHill
Andrew Knight, Basics of Matlab and Beyond, Chapman & Hall/CRC
Programação em MatLab, para Engenheiros. Stephen Chapman, Thomson Learning.
Matlab – Language of Technical Computing, The Mathworks Inc
Introdução ao Matlab, Folhas de Apoio às aulas, Luis Mendonça.
Documentação utilizada pelo docente nas aulas

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Teaching methods:
The syllabus of this course enables the student to learn basic algorithms as well the basic instructions on programming structures. The resolution of practical exercises in the field of engineering enable students to develop the learned knowledge in terms of algorithms and implementation of programming frameworks. The implementation of an application will use the algorithms, structures programming and reporting, which includes user manual and programmer manual and presentation of work. Therefore the student will gain skills in programming in the workplace. Aiming to enable students to understand the topics required in this course develops, articulately, teaching the theoretical and practical problem solving. For each of the subjects presented in lectures, has designed a series of problems with resolution included. Will be adopted methodologies and teaching strategies in the classroom that promote active student participation in the construction of knowledge by encouraging the mastery of theoretical knowledge in practical application. With the resolution of practical exercises is intended that the student acquires valences that will allow the resolution of the final work. At each new topic lectured is made application examples, that its implementation may involve the computer application in question. Examples always have an integrating knowledge with the aim of preparing students for the execution of the final work.
Assessment methods:
The classes have a theoretical and practical character. 1. ONGOING EVALUATION a) The frequency of lectures is mandatory. Thus, students have to use the continuous assessment must attend a minimum of 80% of the lectures. b) The student must pass a written test and may not have a grade below 9.5. c) To pass the practical component, students should perform practical work and submit its report. The minimum should be 9.5. d) Final Grade = 0.5X + Rating Test Work 0.5xNota f) If the student wishes to earn a grade higher than 16, should undergo an oral examination. 2. FINAL EXAM FOR EVALUATION a) The student who has not performed the test, or has failed in its evaluation, may apply for one of the dates of final exam for a second season. The student who has failed the 1st time you run the test resource. The minimum score to be approved on the final exam is 9.5. b) Final Grade Final Exam = 0.5X + Note Work 0.5xNote c) If the student wishes to earn a grade higher than 16, should undergo an oral examination.

Language of instruction:	Portuguese / English

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Description of individual course unit

Course title:	**Maritime Technology**		
Field:	Technical Management		
Course code:	923005	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	1º
ECTS:	4	**Hours/week:**	60 h TP
Name of lecturer:	Luís Filipe Baptista		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Provide a regulatory, legislative and administrative overview of the maritime activity. Promote the understanding of ships as production units with high autonomy. Teach the concepts about the nautical qualities, dimensions, and capacity of vessels. Identify the constructive aspects of the various types of ships according to their purposes. Characterize the main types of propulsion and auxiliary plants by identifying its components and their functions. Identify steering systems and their operation. Characterize the different systems for loading and unloading cargo. Develop navigation and manoeuvring skills with lifeboats and rescue boats, including berthing and umber thing manoeuvres, man overboard and towing, according with IMO-STCW Convention and amendments.

Course contents:

A. MARINE TECHNOLOGY (30 hours)

1. Regulation of Maritime Transport (2 hours)
2. Classification and general structure of ships (2 hours)
3. Nautical qualities, positioning, geometric planes, dimensions and capacities of Ships (4 hours)
4. Prime Movers, Including Main Propulsion Plant (6 hours)
6. Engine Room Auxiliary Machinery (4 hours)
7. Steering Systems (4 hours)
7. Cargo Handling Systems (4 hours)
8. Deck Machinery (4 hours)

B. MARINE NAVIGATION (30 hours)

9. The terrestrial sphere
10. Direction at Sea
11. General information about Navigational Charts
12. Terrestrial Magnetism
13. Coastal navigation
14. Estimated navigation
15. Sextant
16. Manoeuvres
17. International Regulations for Preventing Collisions at Sea
18. Nautical weather
19. Basic understanding of first aid.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.1 BASIC UNDERSTANDING OF THE OPERATION OF MECHANICAL ENGINEERING SYSTEMS – (22/102 hours)
Item 3.1.3 PROACTIVE MEASURES TO PROTECT THE MARINE ENVIRONMENT – (1/1 hours)

Recommended reading:

Textos de apoio à unidade curricular
Arte Naval Moderna – Rogério Castro Silva

Tecnologia Della Nave – Alberto Lomeo
Merchant Ship Construction – Pursey H. J.
Merchant Ship Types – Munro Smith
O Navio – Landstrom, Bjorn

Teaching methods:

To initiate students in the study of Maritime Technology, are introduced on the theoretical study of the structure and technology of the ship as well as the fundamental topics on shipping. Aiming to enable them to analyse the various topics, presents the fundamentals of the various subjects through PowerPoint presentations and videos on the subjects taught in class. To consolidate the knowledge transmitted and sensitize students to some practical issues related to the subject taught, practical exercises are carried out with nautical charts and study visits to a merchant ship, shipyard and laboratory simulation installation of marine machinery.
Theoretical-practical lectures, with short expositions about each subject, followed by practical examples. Problem's resolution where the students apply the knowledge acquired and consolidate the concepts needed. Aiming to enable students to analyse both the materials given, how to implement and test in the laboratory, the work required in this course develops, articulately, on two levels: theoretical and practical teaching. For each of the chapters presented in lectures, notes designed to support students so that they can properly assimilate the theoretical knowledge. Thus, it encourages the individual and group work inside and outside the classroom context.

Assessment methods:

This course consists of modules of marine machinery and marine navigation. Evaluation during the semester will be carried out by at least one written test for each module. For the final classification of this unit, each module contributes with 50%. The final rating will be determined by the arithmetic mean of scores in each module (minimum classification of each module is 9.5 points). If the student obtains an evaluation less than 9.5 in any of the modules, then complete the final exam. The assessment in final exam of each module will focus all the topics taught in it. The obtained approval is obtained with a grade equal or higher than 9.5 points.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**English**		
Field:	Technical Management		
Course code:	923006	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	1º
ECTS:	4	**Hours/week:**	45 h TP
Name of lecturer:	Olga Delgado		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The objective of this course is to prepare students for developing the full knowledge, understanding and proficiency in English required by the STCW Code. To give students wide-ranging opportunities to practise communicating in English both written and oral for both maritime and general purposes at elementary to lower intermediate language level. Along with the specific sets of technical learning and maritime vocabulary (relating to more detailed issues ahead), we intend to make a review of the most important grammatical structures of the English language.

Course contents:

1. **Specialized Maritime English for ElectroTechnical Officers (ETO)**

Gramatical structures in english language:
Nouns, verbs, adjectives, adverbs, pronouns, propositions and conjunctions.
Verb Tenses; negatives and questions;
Non-regular and modal verbs;
Reported speech;
Prepositions and phrasal verbs;
Comparative, superlative and idiomatic comparisons;
Passive Voice v. Active voice;
Reading comprehension;
Speaking – role playing professional and personal settings;
Listening – different types if English accents;
Writing – report writing, translation and interpretation;

Vocabulary areas:
Terminology and technical maritime industry vocabulary
Different activities in the maritime sector;
The types of ships - types of cargoes, stevedoring, unloading and loading; operations, and terminology of the different parts of the ship;
Organisation and responsibilities on board a ship;
Maritime terminology and vocabulary;
Dimensions of the ship, GT, NT, Deaweight, etc;
Navigation concepts;
General terms of an eletrical network of a ship;
Regulations and conventions on security and the safety of life at sea.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
1.6.1 Adequate knowledge of the English language to use engineering publications (15/15 hours)

Recommended reading:

Improve Your Written English - Fifth Edition, Maion Field
Basic English Grammar – Third Edition, Betty Schrampfer Azar and Stacy A. Hagen

Fundamental of English Grammar – Third Edition, Betty Schrampfer Azar
Improve your written English – Fifth Edition, Marion Field
Elements of Shipping – Eighth Edition, Alan E. Branch
English for Maritime Studies – Second Edition, T N Blakey
Apontamentos e exercícios, Melany Martins 2010, Escola Superior Náutica Infante D. Henrique

Teaching methods:

It is intended that students develop the skills to perform tasks, in a professional work environment, in English, independently and without difficulty.
To initiate students in the study of the course Technical English, the introduction to grammar and specific technical vocabulary. This vocabulary and other materials are inserted into specific themes of Maritime English. The objective is to enable students to analyse the various topics, presented through the fundamentals of the various subjects through PowerPoint presentations and videos taught in class. To consolidate the knowledge transmitted and encourage students to the practical component, practical exercises such as "roleplaying" are given.
The teaching methodology includes theoretical-practical lectures. In the lectures the students will be given detailed explanations about the topics which will then be applied in practical examples and exercises. It is also expected and important that the students prepare themselves by self-studying and doing required assignments.
Aiming to empower students to analyse both the materials given and how to implement and test their knowledge of the material given, the coursework required in this course is developed on two levels: lectures and practical exercises. For each chapter presented in the class room, notes are given that are used as a study support for students, so that they can properly assimilate the theoretical knowledge. Thus, it encourages the individual and group work inside and outside of classroom context.

Assessment methods:

The assessment consists of the following:
Two tests (each test is divided into an oral and written section) - one at mid-semester and one at the end of the semester. Minimum score: 8 with an average 10 or superior.
Students can opt for only taking the final exam at the end of the semester. Minimum score 10.

Language of instruction:	Portuguese / English

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Individual Course Units Syllabus

1st Year – 2nd Semester

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Mathematics II**		
Field:	Mathematics		
Course code:	923007	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	2º
ECTS:	6	**Hours/week:**	75 h TP
Name of lecturer:	João Nuno Garcia Nobre Prata		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The primary objective of the course is to develop a working knowledge of Mathematical Analysis with Special emphasis in differential and integral calculus in Rn. This knowledge will allow the student to establish the mathematical models that are needed to analyse the physical problems of engineering.

Course contents:

1. Differential Calculus in Rn.
Scalar fields: limits, continuity, partial derivation, directed derivative, gradient, implicit function derivative, composite function derivative, free extremes and conditional extremes.
Vector fields: limits, continuity and derivatives: The Jacobian matrix, the Jacobian, divergence, rotational, Laplacian and invertiblity.

2. Integral Calculus.
Double and triple integrals. Application to area and volume calculation. Polar, cylindrical and spherical coordinates.
Line integrals. Conservative fields and path independence. Green's Theorem. Surface integrals. Divergence and Stokes theorems.

3. Differential Equations.
Introduction and terminology. Separable equations, linear, accurate and reducible to exact.

Recommended reading:

Calculus – H.Anton, I. Bivens, S. Davis, John Wiley & sons, 2002.

Teaching methods:

The goal of the course unit Mathematical Analysis II is to continue to develop the student ability to use mathematical reasoning, mainly using differential and integral calculus in the vectorial space Rn. The topics studied are the generalization of the topics previously studied in the course unit Mathematical Analysis I.
This kind of reasoning give them tools to construct mathematical models to solve problems occurring in Engineering. Thus, the syllabus includes first a section about differential calculus in Rn, followed by integral calculus with a great focus in the many applications which appear constantly in Engineering.
The teaching methodology includes theoretical-practical lectures. It is also expected that the student prepare themselves by reading each topic in the recommended readings. In the lectures the students will be given brief exposition about the topics, followed by examples and exercises. The students are also given weekly exercises to solve at home.
The classes are separated in theoretical and practical classes throughout the semester. In each week, a new topic is presented and studied in the theoretical classes, followed by some examples and applications. In the beginning of the practical classes one or to exercises may be solved but the remaining exercises must be solved by the students individually or in small groups. The exercises are available in the previous week so that the students may start to solve them after the topic is presented in the theoretical classes.

The course evaluation consists in tests throughout the semester and/or final exam. The exams are performed to test the mathematical reasoning to solve problems without the use of notes and calculator.
Assessment methods:
1- **Continuous assessment:** two 90 minutes tests, each with a minimum score of 7/20 points. The final grade is the average of the grades in the two tests. 2- **First exam date:** 1 exam for those students who failed in the continuous assessment. 3- **Second exam date:** 1 exam for those students who failed in the previous assessment dates or those students who want to improve their grades.

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Electrical Circuits**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923008	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	2º
ECTS:	6	**Hours/week:**	75 h TP
Name of lecturer:	José Manuel Dores Costa		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The goal is to provide students with the scientific foundations of electromagnetism and its applications. Students should be able to understand the steady state behaviour of electrical circuits with passive components, both with DC and alternating sinusoidal currents. Itis also indented to provide knowledge about transient's phenomena in electrical circuits. Mesh and node analysis are focused for DC and both for single phase and three-phase circuits.
Lab classes are used for experimental issues, and students are encouraged to use electrical and electronic measuring and test equipment for fault finding, maintenance and repair operations.
This course serves as basic preparation for sequent courses in the area of electrical engineering and electrical machinery, electronics and automation and control.

Course contents:

1. **Characterization of the electromagnetic field.**
   Electrical linear circuits in DC current. Ohm's law, electrical resistance. Joule's laws. Electrical energy and power.

2. **DC Circuits: Mesh and node analysis.**
   Electromotive force. Kirchhoff's laws. Superposition principle. Thevenin and Norton theorems. Maximum power transfer.

3. **Sine wave AC Circuits.**
   Amplitude, rms, period and frequency. Phasors. Inductors and capacitors. Reactance, impedance and admittance concepts. Active, reactive and apparent powers. Power factor and its compensation. Adapted load.

4. **RLC resonant circuits.**
   Voltage and current resonance. Oscillator. Quality factor. Introduction of filters and frequency responses.

5. **Circuits with magnetic coupling.**
   Electromagnetic induction. Faraday's induction law.
   Magnetic circuits. Magnetic reluctance. Self and mutual inductances.
   The Ideal transformer.

6. **Three-phase systems and circuits.**
   Phase-to-neutral and phase-to-phase voltages.
   Three-phase active, reactive and apparent steady-state powers.

7. **Transients in electrical circuits.**
   Transient solution and steady-state.

8. **Componente prática/laboratorial**

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.3 ELECTRO-TECHNOLOGY AND ELECTRICAL MACHINES THEORY – (41/75 hours)
1.1.3.1 – Basic concepts (6 hours)

1.1.3.2 – DC Circuits (10 hours)
1.1.3.3 – AC Circuits (15 hours)
1.1.3.4 – Magnetism and electromagnetic induction (10 hours)

Item 2.1.6 THE INTERPRETATION OF ELECTRICAL AND ELECTRONIC DIAGRAMS – (18/30 hours)

2.1.6.2 Diagrams (8 hours)
2.1.6.4 Interpretation of diagrams (10 hours)

Recommended reading:

Electricidade Aplicada para Engenheiros, L. Bessonov, Lopes da Silva Ed., 2000.
Basic Engineering Circuit Analysis, J. D. Irwin, Wiley Ed., 2002
Apontamentos de Electrotecnia, Mário Assunção, ENIDH
Fichas de laboratório dos docentes da disciplina

Teaching methods:

This curricular unit must give the fundamental knowledge for electronics and automation training, providing students with the essentials about electric and magnetic circuits, and the laws and principles that govern them. The course begins with linear DC circuits then continuing with sinusoidal AC circuits. At first, circuits are Analysed in steady-state and then transients are studied. This course is the initial training in the area of Electrical machines and power systems, electronics, telecommunications and automation and control. Special care is taken dealing with electric active, reactive and apparent power and power flow calculus. Theoretical instruction is supplemented with laboratory classes where students perform illustrative experiments, and Practical applications are studied. Also, measurement equipment and test methods are used.
Class will consist primarily of presenting fundamental physics, maths and engineering concepts through working problems, and discussing in-class demonstrations. Key points will be highlighted by the choice of examples, and these points will be discussed in the context of the example and electric circuit's theory. Practical lab experiences are performed to demonstrate engineering applications and results are discussed in the context of the work.
Classes are divided into theoretical and laboratory practical ones. The first are intended for theoretical exposition and resolution of typical and illustrative problems in each chapter. Laboratory classes complement the theoretical exposition with experimental demonstrations about electrical circuits. A practical guide is previously distributed to students describing the experimental work to be done. At the end, a concise report, that must include the objectives, simulation and experimental results, is presented for evaluation. Experimental classes are also intended to teach about laboratory apparatus to measure electrical quantities and waveforms viewing.

Assessment methods:

Grading is based on individual written tests (2) with minimum 7 points in each ou final exam. and several lab work reports which are mandatory. The final exam is comprehensive.
The final average will be computed as follows: 60% will be from lecture tests or final exam, 40% from lab works. Each component must have a grade not less than 9,5 points.

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Circuits Technology, Simulation and Test**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923009	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Abel da Silva Simões		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

According to the STCW Section A-III/6 (Mandatory minimum requirements for certification of electro-technical officers) and the IMO Model 708 Course,:
- Characterize and test the main electrical and electronic components;
- Use electrical and electronic norms and symbology;
- Use test and measurement equipment
- Know and use most commonly used programs in circuit simulation;
- Characterize printed circuit boards and types of fabrication.
- Knowledge of safety requirements in the handling of electrical circuits.

Interpretation of electrical and electronic diagrams.

Course contents:

1. Electrical standards and conventions (3 h)
- Electrical conventions and standards
- Units of the International System (SI)
- Prefixes and measurement suffixes
- Relative and Absolute Measurement Scales
- Types and levels of electrical signals

2. Technology of electrical materials (15 h)
- Electrical, thermal, optical and magnetic properties of materials, factors that cause their variations and the main technological applications
- Factors that characterize electrical materials: conductivity, resistivity, temperature, permeability, losses, etc.
- Selection criteria for materials suitable for certain applications
- Characterization of conductors, superconductors and semiconductors
- Characterization of dielectric materials and insulators
- Characterization of magnetic materials
- Characterization of electrical and electronic components: resistors, capacitors, coils, diodes, transistors, operational amplifiers and integrated circuits
- Influence of the marine environment on the durability of electrical materials
- Future development of electrical materials technologies for marine applications

3. Safety requirements for working on shipboard electrical systems (15 h)
- Electricity Risks
- Effects of electricity on the human body
- Appropriate workplace safety measures;
- Personal protective equipment and care in the handling of equipment;
- Protective care in electrical installations (IEC 1010-1 Standard);
- Work safety analysis
- Selection and use of appropriate measuring instruments, test equipment and hand tools, accurate interpretation of results;
- Precautionary measures to disassemble, repair and reassemble equipment in accordance with manuals and best practices;
- Safety measures to test equipment performance according to manuals and best practices.

4. Construction and operation of electrical testing and measuring equipment(15 h)
- Characterization of the construction and operation of electrical, analog and digital, fixed and portable instruments: ohmmeter, voltmeters (AC, DC), ammeters (AC, DC), frequency meter, wattmeter, phasemeter, oscilloscope, etc.
- Fundamentals of measurement of resistance, voltage, current, frequency and power measurement

- Interpretation of measurement results of multimeters and oscilloscopes
- Signal Generators
- Power Supplies

5. The interpretation of electrical and electronic diagrams (12 h)

- Standards and general symbology
- Interpretation of the electrical and electronic graphic symbols used in the diagrams: electric generators, motors, transformers, electrical appliances: contacts, switches, circuit breakers, relays, time relays, thermal relays, contactors, signal lights, fuses, luminaires, switches, sockets, boxes sensors and measuring devices, diodes. bipolar transistors, thyristors (SCRs), GTOs, TRIACs, MOSFETs, IGBTs, IGCTs.
- Types of electrical and electronic diagrams
- Schematic drawing of circuits and electrical installations of telephones, telecommunications, equipment and motors
- Technical documentation of ship equipment and machinery
- Methods of interpretation of electrical and electronic diagrams for control, protection, automatism and signalling
- Simulation of electronic circuits: simulation programs and characteristics of DC, transient and AC analysis
- Printed circuit board
- Welding of electronic components

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:

Item 1.1.9 Technology of electrical materials – (15/15 hours)
Item 2.1.1 Safety requirements for working on shipboard electrical systems – (15/15 hours)
Item 2.1.4 Construction and operation of electrical testing and measuring equipment – (15/15 hours)
Item 2.1.6 The interpretation of electrical and electronic diagrams – (12/30 hours)
2.1.6.1 Graphic symbols (6 h)
2.1.6.3 Technical documentation (6 h)

Recommended reading:

- Cadick J., Electrical safety in marine environment. Cadick Corporation, Technical Bulletin 010, January 2001
- Cadick J. et al, Electrical safety handbook, Third Edition, McGraw Hill 2005
- Code of safe working practices for merchant seamen, London. The Stationery Office Publications Centre, 1998
- Code of safe working practices for merchant seamen, Maritime and Coastguard Agency (MCA), London. The Stationery Office Publications Centre, Consolidated Edition, 2009
- Kasap S., Principles of electronic materials and devices, Third Edition, McGraw-Hill, 2006
- Kossowski K., Introduction to the theory of marine turbines. Foundation for the Promotion of Marine Industry. Gdańsk 2005
- Zachariason R., Electrical materials, Thomson, Delmar Learning, 2007
- Manufacturers' manuals
- Ship's electrical systems – safety and maintenance
- Electrical survey requirements
- Electronic components and technology, Stephen Sangwine
- Passive electronic component handbook, Charles A. Harper
- Manual and supporting texts, Abel Simões

Teaching methods:

The theoretical classes consist of brief expositions about each theme, followed by examples, where the student is expected to consolidate the concepts.
In the practical classes will be the knowledge of the main components, devices and electrical and electronic circuits where the students will apply the acquired knowledge. The student must respond with appropriate procedures and correct skills.

Assessment methods:

Continuous assessment: 2 tests (T1 and T2) and practical work (TP).
There is a presence register in the practical classes. For students with a frequency below 80%, they will be considered to be disapproved and not admitted to the final exam.
Final score of continuous evaluation NFAC = (T1 + T2) / 2 * 0.5 + TP * 0.5 values, with the condition of T1> 8 and T2> 8; (T1 + T2) / 2> 10 values; and NFAC> 10 values.
For students admitted to the examination, the final mark NFAE = Ex * 0.6 + TP * 0.4 values

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Probabilities ans Statistics**		
Field:	Mathematics		
Course code:	923010	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	João Nuno Garcia Nobre Prata		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Knowing and applying the basic techniques of Statistics, Statistical Inference and Correlation Theory. Understanding the theoretical grounding of these areas on Probability Theory. Getting acquainted with and applying some of the main probabilistic models and estimating and testing the parameters needed to their application. Applying these concepts and methodologies to problem solving in Engineering.

Course contents:

1. Statistics
2. Probability Theory. Basic concepts
3. Statistical Inference.
4. Correlation and regression

Recommended reading:

Textos de apoio às aulas teórico-práticas, Maria Elisa Cunha
Introduction to probability and statistics, W. Mendenhall, R. Beaver & B. Beaver. Duxbury Press, 1999
Estatística, R. C. Guimarães & J. S. Cabral. McGrawill, 1997.
Exercícios de Estatística Vol I e II, J. Fonseca & D. Torres. Edições Sílabo, 2000.

Teaching methods:

The unit contents are consistent with the objectives of the course because it is intended to raise awareness of the basic methodologies of the Descriptive Statistics, the Statistical Inference, the Correlation and the Probability Theory. Along the course are developed case studies within the engineering area.
The course unit minister to the students the critical thinking skills, analyse situations, solutions and synthesis of information, so that the students is able to find the best method to solve a problem, understand and draw conclusions from their results.
Classes include a brief theoretical exposition of each topic, practical examples of applicability and exercises. Students are given weekly exercise lists for home practice.
The teaching methodologies are consistent with the objectives of the course since the expository method enables to achieve all the objectives.
The methodology of work by the student in solving exercises and case studies with the aim of consolidating the knowledge and approach of case studies and small research tasks for students to develop outside contact hours, enables also reached the objectives intended for the curricular unit.

Assessment methods:

1-Continuous assessment: two 90 minutes tests, each with a minimum score of 7/20 points. The final grade is the average of the grades in the two tests.
2-First exam date: 1 exam for those students who failed in the continuous assessment.
3-Second exam date: 1 exam for those students who failed in the previous assessment dates or those students who want to improve their grades.

Language of instruction:	Portuguese / English

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Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Industrial Chemistry**		
Field:	Thermal Instalations		
Course code:	923011	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	2º
ECTS:	6	**Hours/week:**	60 h TP
Name of lecturer:	Maria João dos Reis Matos Cebola		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Provide students with the fundamentals of chemistry in order to understand the structure of matter and atomic and molecular organization. Study the nature of covalent chemical bond to ensure a multi approach of these molecules (stereochemistry, electronic couple isolated, polarity: binding and permanent, chemical reactivity). Study the intermolecular forces as an analysis tool to complement other properties (solubility, melting and boiling points).
In partial summary: It is intended that students are able to apply the knowledge and analytical tools in terms of chemical and physical properties of any substance listed in the Dangerous Goods Code of the International Maritime Organization.
Knowing the IUPAC nomenclature of hydrocarbons and organic compounds and organic functions in order to be able to identify the petroleum products, including polymers and fuels. Pursuant to address the combustion reactions in multiple perspectives: molars and mass balance, and relative fuel / air.
Introduce the concept of chemical equilibrium as the basis of acid-base equilibrium and oxidation-reduction in order to achieve practical levels as electrochemical corrosion and the corrosion protection system (cathodic protection by imposed current sacrificed anodes and schema-ink painting). Understand and apply the acid-base of knowledge and redox maritime boilers. Acquire skills in: control and water treatment, water analysis and treatment system products. With laboratory practices intended to acquire their own skills in perspective: the interpretation of results in the definition of malfunction levels of boiler bodies and in decision-making regarding the type and extent of chemical treatment to be used.
It is a further object of discipline understanding of the fundamental concepts of marine pollution. Ensures students know how important some of the regulatory instruments and procedure stipulated by MARPOL 73/78 - Protocol to the International Convention for the Prevention of Pollution from Ships:
Annex I (by oil in tankers),
Annex II (by harmful substances) and Appendices, as recommended by the Convention IMO-STCW and Amendments.
Annex III: Pollution by Harmful Substances in Packaged Form
Annex IV: Pollution by Sewage from Ships
Annex V: Pollution by Garbage from Ships
Annex VI: Prevention of Air Pollution from Ships

Course contents:

1. Electronic structure of atoms (STCW Code - Sections AV / 1-1 and AV / 1-2)

2. Chemical Bonding (STCW Code - Sections AV / 1-1 and AV / 1-2)

3. Molecular Geometry and chemistry in global heating (STCW Code – Sections A-V/1-1 e A-V/1-2)

4. Energy, Chemistry and Society (STCW Code – Sections A-V/1-1 e A-V/1-2)

5. Hydrocarbons and Organic Chemistry (STCW Code - Sections AV / 1-1 and AV / 1-2)

6. IMDG Introduction

7. Physical States of matter and Phase Transitions (STCW Code - Sections AV / 1-1 and AV / 1-2)

8. Chemical Equilibrium

9. Electro-Chemistry

10. Treatment and water analysis for offshore facilities station A-V / A-1-1 and V / 1-2)

11. Prevention of pollution of the marine environment (STCW Code - Sections AV / 1-1 and AV / 1-2)

12. Risks associated with operations on tankers (STCW Code - Sections AV / 1-1 and AV / 1-2)

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 3.1.1 THE PRECAUTIONS TO BE TAKEN TO PREVENT POLLUTION OF THE MARINE ENVIRONMENT – (20/20 hours)

3.1.1.1 International Convention for the Prevention of Pollution from Ships, (MARPOL 73/78) (14 hours)
3.1.1.2 Conventions and legislations adopted by various countries – (4 hours)

Recommended reading:

Chemistry, molecules, matter and change, Peter Atkins e Loretta Jones, 3ª ed. W.H. Freeman and Company
Química, Raymond Chang, 8ª ed. 2005, McGraw Hill
Physical Chemistry, P. W. Atkins , 6ª ed. Oxford University Press
Química Orgânica. R. Morrison, R. Boyd, 6ª ed. Fundação C. Gulbenkian
Petróleo & derivados, Caret Campos e Leontsinis, 2ª ed., JR editora técnica
Corrosão, Vicente Gentil, 3ª ed. Guanabara
Tratamento de água de instalações marítimas (apontamentos do docente)
Tanker Familiarization, IMO Model Course 1.01: 2013

Teaching methods:

To initiate students in the study and the field of applied chemistry course, introduced into the theoretical bases on the syllabus. In order to enable them to analyse various examples are shown on each of the topics addressed, relating them to practical cases. To consolidate the knowledge transmitted, are solved exercises on the subjects studied and performed laboratory work.
The teaching will be done through theoretical and practical classes and practical classes and laboratory.
The theoretical and practical work with brief presentations on each topic, followed by practical examples, where you want students consolidate the concepts. The practical classes and laboratory correspond to times where the student can check the correspondence of the processes and methods studied.
Aiming to empower students to analyse materials given the work required in this course develops, articulately, on two levels: theoretical and practical lectures. For each of the chapters presented in lectures, conceived up notes to support students so that they can properly assimilate the theoretical knowledge. In order to consolidate the material taught in class, practical work in the laboratory are performed by groups of students. Thus, it encourages individual and group work within and beyond the classroom.

Assessment methods:

3 reports (photoelectric cell, chemistry element and chemical study of a molecule listed in the Dangerous Goods Code): (Nchi). Conducting one laboratory work (7 tests) in groups (in water treatment facilities maritime) (NTP)
Realization of 1 test at the end of the semester, evaluating from the Chapter: Hydrocarbons and Organic Chemistry to the Chapter: Pollution (NT)
The final (NF) in continuous assessment is the result of NF = = 0.25x Nchi) +0.15 x (NTP) + 0.60 (NT)
On examination, the requirement for submission of 3 reports and the results of analysis of water.

Language of instruction:	Portuguese / English

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Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Technical Maritime English**		
Field:	Technical Management		
Course code:	923012	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	1º	**Semester:**	2º
ECTS:	4	**Hours/week:**	30 h TP
Name of lecturer:	Olga Delgado		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The objective of this course is to prepare students for developing the full knowledge, understanding and proficiency in English required by the STCW Code. To give students wide-ranging opportunities to practise communicating in English both written and oral for both maritime and general purposes at elementary to lower intermediate language level.

Course contents:

1. **Specialized Maritime English for ElectroTechnical Officers (ETO)**
   Grammar:
   Word order, equivalents, untranslatable, Anglicism and use of English words in Portuguese; Comparisons, passives and other idiomatic constructions;
   Connectors;
   False meanings;
   Different systems of weights and measures; 'Cause and effect' relationships and links;
   Describing machinery: How to make presentations;
   Meetings: discussing technical issues;
   Communication and professional relationships: Socializing.
   Vocabulary areas to be learnt are as follows:
   Propulsion plants;
   Auxiliary machinery;
   Electrical machinery, switchboards and circuits;
   Bunker fuels and lubricants;
   Maintenance and repair.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.6.2 Adequate knowledge of the English language to perform the officer's duties (15/15 hours)

Recommended reading:

Introduction to Marine Engineering – Second Edition, D. A. Taylor
The Maritime Engineering Reference Book, Anthony F. Molland
Handbook if Correspondence , Oxford University Press, A. Ashely
MarEng Software
Apontamentos e exercícios, Melany Martins 2010, Escola Superior Náutica Infante D. Henrique

Teaching methods:

It is intended that students develop the skills to perform tasks, in a professional work environment, in English, independently and without difficulty.
To initiate students in the study of the course Technical English, the introduction to grammar and specific technical vocabulary. This vocabulary and other materials are inserted into specific themes of Maritime English. The objective is to enable students to analyse the various topics, presented through the fundamentals of the various subjects through PowerPoint presentations and videos taught in class. To consolidate the knowledge transmitted and encourage students to the practical component, practical exercises such as "roleplaying" are

given.
The teaching methodology includes theoretical-practical lectures. In the lectures the students will be given Detailed explanations about the topics which will then be applied in practical examples and exercises. It is also expected and important that the students prepare themselves by self-studying and doing required assignments. Aiming to empower students to analyse both the materials given and how to implement and test their knowledge of the material given, the coursework required in this course is developed on two levels: lectures and practical exercises. For each chapter presented in the class room, notes are given that are used as a study support for students so that they can properly assimilate the theoretical knowledge. Thus, it encourages the individual and group work inside and outside of classroom context.

Assessment methods:

The assessment consists of the following: Two tests (each testis divided into an oral and written section) - one at mid-semester and one at the end of the semester. Minimum score: 8 with an average 10 or>.
Students can opt for only taking the final exam at the end oft he semester. Minimum score 10.

Language of instruction:	Portuguese / English

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Individual Course Units Syllabus

2nd Year – 1st Semester

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Applied Mechanics**		
Field:	Applied Mechanics		
Course code:	923013	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Victor Manuel Franco Correia		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The main objective is to develop in the engineering student the ability to analyse the mechanical concepts and Mechanics of Rigid Body tools which are used in the structures modelling.
It is also expected that students can learn the mechanical concept applications as a tool in engineering system analysis, which can develop their knowledge and skills in order to study multibody systems.
The aim is to introduce the students to the fundamental concepts of equilibrium and mechanical interactions among bodies, which forms the bases for understanding complex models used in structures analysis

Course contents:

1. Statics of particles
2. Equilibrium of rigid bodies
3. Centroids and centers of gravity
4. Analysis of structures
5. Friction
6. Dynamics
7. Introduction to the vibration analysis
8. Hydromechanics

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.2 BASIC KNOWLEDGE OF HEAT TRANSMISSION, MECHANICS AND HYDROMECHANICS – (10/14 hours)
- 1.1.2.1 BASIC KNOWLEDGE OF MECHANICS (6 hours)
- 1.1.2.1 BASIC KNOWLEDGE OF HYDROMECHANICS (4 hours)

Recommended reading:

Vector Mechanics for Engineers – Vol. I – Statics, Vol. II - Dynamics, F. P. Beer e E. R. Johnston Jr., McGraw-Hill.
Engineering Mechanics – Vol. I – Statics, Vol. II - Dynamics, R. C. Hibbeler, Prentice-Hall.
Mechanical Vibrations: International 4th edition, S. S. Rao, Prentice-Hall.
Vibrações Mecânicas - Introdução, Textos de apoio, Victor Franco, ENIDH.

Teaching methods:

The syllabus emphasis the understanding of the mechanics principles and their application to solving practical problems in engineering. The vector analysis is one of the most important tools. Program contents of the statics of particles, statics and equilibrium of rigid bodies, centroids and centres of gravity, analysis of structures, friction and dynamics, allows the student to approach to other curricular units, such as Mechanics of Materials or Machinery, as well as any mechanical system in terms of its design or function. Program contents allow the student to be able to calculate the external loads in mechanical components. The vibration study for systems with one degree of freedom provides an understanding of the main vibration concepts.

Theoretical and theoretical-practical lectures. Presentations on each topic, followed by practical examples. Some of these lectures involve experimental work. In the first lessons the approach to vector analysis which is used in the discussion of the Mechanics Fundamental Principles is presented. Three-dimensional problems are solved by vector analysis that leads to a simplest solution. In the theoretical and practical lessons of mechanics of particles is separated from the mechanics of rigid bodies which makes it possible to consider simple practical applications progressing to more complex concepts. The statics of particles is treated first where the principle of equilibrium of a particle is immediately applied to practical situations involving concurrent forces. The statics of rigid bodies is treated at a later stage. The concepts and principles of mechanics are presented within the context of simple applications. The free-body diagrams are used to solve equilibrium problems and to present the system of equivalent loads. Practical applications and several methodologies for problem solving are also presented. The laboratory experiments help to understand the workings of frame structures and friction belts. Theoretical and practical lessons also allow understanding of the main concepts of the dynamics and their implications in the analysis of mechanical systems, as well as understanding of the main concepts associated with vibrations for systems with one degree of freedom.
Assessment methods:
Two laboratory exercises, mandatory (NL). Two tests with a minimum classification (8) in each of them or a final exam (NE). Evaluation: NF = 0.15 x NL + 0.85 NE.

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Thermodynamics**		
Field:	Thermal Instalations		
Course code:	923014	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Manuel Duarte Dias Mendes Nogueira		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

To provide to the student the knowledge in applied engineering thermodynamics that will be necessary in different courses of engineering science and of specially, according with IMO-STCW Convention.

Course contents:

1. Thermodynamics properties data and diagrams of fluids.
2. First law of thermodynamic.
3. Second law of thermodynamic.
4. Thermodynamic relations.
5. Vapour power cycles.
6. Gas power cycles.
7. Refrigeration and heat pump cycles.
8. Refrigerated containers

Recommended reading:

Método das Áreas; Nogueira, Manuel D. D. M.
Michael J. Moran, Howard N. Shapiro; Fundamentals of Engineering Thermodynamics; 2nd Edition, SI Version, 1993, John Wiley & Sons, Inc..
Rogers, G. F. C., Mayhew, Y. R.; Engineering Thermodynamics, Work and Heat Transfer; 4th Edition, 1992, Longman Inc., New York, U. S. A..
Faires, V. M., Simmang, C. M.; Thermodynamics; 6th Edition, 1978, Collier Macmillan, New York, U. S. A..
Cengel, Y. A., Boles, M. A.; Termodinâmica; 2001, McGraw-Hill

Teaching methods:

To introduce students to the study of thermodynamics, introduced into the theoretical basis and fundamental concepts of the study of thermodynamics. In order to enable them to analyse the fundamentals of the UC, presents the topics of the various materials through PowerPoint presentations of a reference book on the subjects taught in class. To consolidate the knowledge transmitted and sensitize students to some issues related to the subject taught, perform up exercises throughout the semester in which the student has to calculate various parameters. For the student has greater practical perception of machinery referred to in this UC, there are an accomplished laboratory work.
Lessons have a theoretical-practical character.
Aiming to empower students to analyse both the given materials, and for implementing and testing in the laboratory, the work required in this course develops, articulately, on two levels: theoretical-practical classes and laboratory practice. A reference book that follows in the theoretical-practical classes, as well as notes of support to students so that they can properly assimilate the subject matter of the UC program. The consolidation of the concepts is achieved by conducting practical exercises in class, in which students have to calculate the basic parameters taught. Additionally, students perform a laboratory test that allows them to move closer to the reality. Thus, it encourages individual and group work within and beyond the classroom.

Assessment methods:

Will be done a practical laboratory work in a refrigeration plant with two evaporation temperatures. 1 practical laboratory work (NTP); 2 tests during semester or 1 final examination (NE); Final classification (NF) is obtained by: NF = 0.2xNTP+0.8xNE.	
Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Electrical Machines and Drives**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923015	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	José Manuel Dores Costa		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Give to the students the fundamentals of transformers and conventional electrical machines and their start up, control and regulation circuits. They are given the fundamentals of three-phase distribution systems and the electro mechanical energy conversion principles. Interpretation of normalized wiring diagrams are also are emphasized.
The intent is to provide the basic preparation about sequent study areas of power electrical, and automation and control systems.

Course contents:

1. Three-phase sinusoidal systems, a Review (3 hours)

2. Converting electromechanical energy (6 hours)
Lorentz Force. Force and torque in electro-magnetic circuits.
Rotating magnetic fields.

3. Transformers (5 hours)

4. Rotating electrical machines. (5 hours)
DC motors. Armature reaction. Machine electro-mecanical characteristics.

5. Three-phase induction machines (9 hours)

6. Synchronous machine (6 hours)

7. Electrical drives (30 hours)
Electrical motors starters and protection apparatus. Schematics.

8. Special machines (3 hours)

9. High voltage machines (3 hours)
Safety Precautions and Technology

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.3 ELECTRO-TECHNOLOGY AND ELECTRICAL MACHINES THEORY – (34/75 hours)
1.1.3.5 – Fundamentals of Electrical Machines – (6 hours)
1.1.3.6 – DC Machines – (5 hours)
1.1.3.7 – Transformers – (5 hours)
1.1.3.8 – Asyncronous Machines – (9 hours)
1.1.3.9 – Syncronous Machines – (6 hours)
1.1.3.10 – Special Machines – (3 hours)
Item 1.1.8 ELECTRICAL DRIVES – (30/30 hours)

Recommended reading:

Fitzgerald, A.E.; Kingsley Jr., C.; Kusko, "Máquinas eléctricas - conversão electromecânica da energia processos, dispositivos e sistemas", McGraw-Hill.
Syed A. Nasar, "Electric Energy systems", Editora Prentice-Hall.
Apontamentos dos docentes da unidade curricular.
Fichas de laboratório dos docentes da unidade curricular.

Teaching methods:

Electrical machines and drives is intended to give students the fundamentals of transformers, rotating electrical machines used on ships, and knowledge about drives, control circuits, and starters. The program begins with single-phase transformers and the fundamentals about electric distribution systems, and energy conversion machines. Three phase systems and rotating magnetic fields are exposed, thus introducing the study of AC rotating electrical machines, both synchronous and asynchronous motors and generators, ending with a reference to DC machines. Standardized electrical schematics are used, and students should be able to know the working principles of electrical machines with their control and starter circuits, to run alternators in parallel, and to share power between them.
The teaching will be done through lectures and laboratory classes. The lectures are for the fundamental concepts, the theoretical exposition of the material and the motivation for personal work. The laboratory classes are intended to carry out practical experiments where the student can verify compliance with the theory, and give practical experience of understanding and management of electrical equipment and switch boards.
Subjects are exposed as a first contact with electrical machines and their drives, emphasis being given to the study of electric and magnetic circuits that constitute them, and to work with electromagnetic induction law. Circuits with contactors and relays, and control and protective systems are studied. Classes are divided into theoretical and laboratory practical ones. The first are intended for theoretical exposition and resolution of typical and illustrative problems in each chapter. Laboratory classes complement the theoretical exposition with no-load and short-circuited tests, and by running electrical motors and generators in different load situations. A practical guide is previously distributed to students describing the experimental work to be done. At the end, a concise report, that must include the objectives, simulation and experimental results, is presented for evaluation.

Assessment methods:

Performing laboratory work in groups and solving problem sets individually and outlaws classes (NTP);
Conducting 2 tests during the semesteror1 final examination (NE);
The final (NF) is the result of: NF=0.4xNTP+0.6xNE. Minimum grade of components: 7values.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Electronics I**		
Field:	Eletronics and Telecommunications		
Course code:	923016	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Abel da Silva Simões		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Students are expected to achieve the competencies in the field of electronics advocated in STCW Sections A-III / 6, B-III / 6 and B-IV / 2 and IMO Model 7.08 Course, namely:
- Knowledge of semiconductor devices: diodes, transistors and operational amplifiers and methods of operation.
- Analyse and design circuits based on these devices: rectifiers, amplifiers, stabilizers low basic circuits and instrumentation.

Apart from the theoretical, discipline is supported by a laboratory component and is directed to ensure the satisfaction of the requirements of industry and ship's electrical installations and electronic equipment.

Course contents:

1. Diodes (8 h)
1.1. Introduction
1.2. The p-n junction
1.3. I (V) characteristic of a diode
1.4. Analysis of simple circuits with diodes
1.5. The Zener diode
1.6. Limiters, clamps and voltage multipliers
1.7. Rectifier and filter circuits
1.8. Voltage regulators in monolithic integrated circuits
2. Bipolar Junction Transistors (14 h)
2.1. Introduction, N-P-N and P-N-P Transistors
2.2. Operating areas
2.3. Polarization and analysis of circuits with DC transistors
2.4. Basic assemblies: common emitter, common collector and common base
2.5. Input and output characteristics
2.6. The transistor as an element of logic circuits
2.7. The hybrid transistor model for small signals
2.8. Amplifier Analysis
2.9. Current Sources
2.10. The differential torque
3. Field Effect Transistors (8 h)
3.1. Introduction, N-P-N and P-N-P Transistors
3.2. Operating areas
3.3. Polarization and analysis of circuits with DC transistors
3.4. Basic assemblies: common fountain, common door and common drain
3.5. Input and output characteristics
3.6. The transistor as an element of logic circuits
3.7. The hybrid transistor model for small signals
3.8. Amplifier analysis
3.9. Current source
3.10. The differential pair
4. Current sources with TJB and TEF transistors (6 h)
4.1. Basic chain mirror (TJB and TEF)
4.2. Widlar current source
4.3. Wilson Current Fountain
5. Operational Amplifier (12 h)
5.1. The ideal operational amplifier

5.2. Characteristics of Operational Amplifiers
5.3. The inverting amplifier
5.4. Non-Inverting Mounting
5.5. Adder amplifier
5.6. The integrator
5.7. The differentiator
5.8. The Difference Amplifier
5.9. The instrumentation amplifier
5.10. Analog Comparators
6. Advanced Circuits with Operational Amplifiers (12 h)
6.1. Real Operational Amplifiers (features limitations and problems)
6.2. Input and output characteristics.
6.3. Precision half-wave rectifier
6.4. Full-Wave Precision Rectifier
6.5. Logarithmic and antilogarithmic amplifier
6.6. Circuits with bridges

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.4 Fundamentals of electronics and power electronics – (30/45 hours)
1.1.4.1 Electronics and power electronics (30 hours)
Item Appendix 6: Basic electricity and electronics

Recommended reading:

- S. M. Sze, "Modern Semiconductor Device Physics", John Wiley & Sons, 1997.
- Jacob Millman, Arvin Grabel, "Microelectronics [Versão Portuguesa: Microelectrónica, 1992]", McGraw-Hill, 2ª ed, 1987
- Adel Sedra, Kenneth Smith, "Microelectronic Circuits, 4ª edição (recomendado) ", Oxford University P., 1997
- M.M. Silva, "Introdução aos Circuitos Eléctricos e Eletrónicos", Fundação C. Gulbenkian, 2001.
- Medeiros Silva, "Circuitos com Transístores Bipolares e MOS", F. Cal. Gulbenkian, 1999
- Barnes M., Practical variable speed drives and power electronics, Elsevier, 2003
- Berger H., Automating with STEP 7 in LAD and FBD: Simatic S7-300/400, SIEMENS
- Berger H., Programmable Controllers in STEP 7 Basic with SIMATIC S7-1200, SIEMENS
- Bird J., Electrical circuit theory and technology, Elsevier 2002
- Blakey T. N., English for maritime studies. 2nd ed., Hemel Hempstead, Prentice Hall International (UK) Ltd, 1987
- Bolton W., Programmable Logic Controllers, NEWNES: ISBN: 978-0750681124
- Bose B. K., Power electronics and motor drives – advances and trends, Elsevier, 2006
- Ellis Norman, Electrical interference handbook, Second edition, Publisher: NEWNES,
- Horovitz P., Hill W., The art of electronics, Cambridge University Press, 1989
- Kasap S., Principles of electronic materials and devices, Third Edition, McGraw-Hill, 2006
- Kaźmierkowski M. P., Tunia H., Automatic control of converter-fed drives, Elsevier 1994
- Khanna Vinod Kumar, The insulated gate bipolar transistor: IGBT theory and design, John Wiley & Sons, INC., Publication;
- McGeorge H. D., Marine electrical equipment and practice, Butterworth-Heinemann, Oxford 2004
- Mohan N., First course on power electronics and drives, NMPERE Minneapolis 2003
- Roy G. J., Notes on instrumentation and control, London Stanford Maritime Ltd. 1985
- Whitaker J. C., Electronic systems maintenance handbook, Technical Press Morgan Hill, California, USA, 2002
- Whitaker J. C., The resource handbook of electronics, Technical Press Morgan Hill, California, USA, 2001
Manual and supporting texts – Abel Simões

Teaching methods:

The theoretical classes consist of brief expositions about each theme, followed by examples, where the student is expected to consolidate the concepts.
In the practical classes will be the knowledge of the main devices and electronic circuits where the students will apply the acquired knowledge. The classes will involve the simulation, assembly, measurement and analysis of circuits and components, where the student must respond with the appropriate procedures and correct dexterity.

Assessment methods:

Continuous assessment: 2 tests (T1 and T2) and practical work (TP).
There is a presence register in the practical classes. For students less than 80% will be considered FAILED.
Final mark of continuous evaluation NFAC = (T1 + T2) / 2 * 0.6 + TP * 0.4 values, with the condition of T1> 8 and T2> 8; (T1 + T2) / 2> 10 values; and NFAC> 10 values.
For students admitted to the examination, the final mark NFAE = Ex * 0.7 + TP * 0.3 values.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Digital Systems**		
Field:	Computers and Digital Systems		
Course code:	923017	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Victor Semedo Gonçalves		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The aim of this course is to provide the students with the knowledge that will allow them to analyse and design digital circuits. Students are to be able to work with combinatorial circuits and sequential circuits. They are also to become familiar with the use integrated circuits belonging to different logic families.

Course contents:

1. Introduction to digital logic
2. Numbering systems
3. Codes
4. Boole algebra
5. Complex logic circuits (5 hours)
6. Encoders and Multiplexers
7. Sequential Circuits
8. Records offsets
9. Topics on digital circuit technology

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.5.1.1 Main Features of Data Processing – (5/45 hours)

Recommended reading:

Victor Gonçalves, Sistemas Digitais I (apresentações em PowerPoint)
Victor Gonçalves e Luís Figueiredo, Fichas de trabalhos laboratoriais
G. Padilla, Sistemas Digitais, McGraw-Hill
H. Taub, Digital Circuits and Microprocessors, McGraw-Hill

Teaching methods:

In order to familiarize the students with digital systems, the theoretical bases of numerical systems and codes are introduced. In order to enable them to analyse and program low complexity systems, elementary logical circuits are introduced and then analysed from a theoretical point of view, by simulating them, assembling them and testing them in the lab.
To consolidate the acquired knowledge and the awareness of some of the practical questions inherent to circuit manipulation, digital integrated circuit technology is also broached.
Theoretical lectures and lab practice
To enable the students not only to analyse and design digital systems, but also to assemble and test them in the laboratory, the teaching has in mind the two-folded goal of trying to match the theoretical knowledge with the laboratorial practice. For every chapter presented in the theory classes, practical laboratorial exercises were designed; for the preparation of all practical items, as well as for the writing of their respective ulterior reports, the students have to master all the associated theoretical knowledge. And thus both individual and group work outside the classroom is stimulated.

Assessment methods:

The grading of students is made of a combination of two written tests and continuous evaluation based on lab reports (on the completion of assignments in lab classes). Minimum grade is 8 on both tests and on the lab reports evaluation. Final grade willconsistof70% of the average of the written tests and30% of the lab reports. The theory component grade can also be obtained in a final exam as an alternative to the 2 written tests.	
Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Data Transmission**		
Field:	Computers and Digital Systems		
Course code:	923018	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Mário Jorge Simão Assunção		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Overview of data transmission, data interfaces and packet switching techniques. The layered approach. OSI and TCP/IP models. Wide area and local area networks. The detailed analysis of OSI layers 1, 2, 3 and associated protocols. Error detection and correction. Operation and performance of ARQ protocols.

Course contents:

1 – Comunications Foundations and Elements (4h)
2 – Analog and Digital Modulations (6h)
3 – Multiplexing (4h)
4 – Introduction to data communications (4h)
5 – Data transmission foundations (18h)
6 – Reliable data transmission (4h)
7 – Data Comunication Industrial Networks protocols (20h)

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.5.2 CONSTRUCTION AND USE OF COMPUTER NETWORKS ON SHIPS – (30/30 hours)

Recommended reading:

William Stallings , 2004, Data and Computer Communications, 7th Edition, Prentice Hall
Leon Garcia, Communication Networks, Fundamental Concepts and Key Architectures, 2nd Edition McGraw Hill

Teaching methods:

In order to introduce the student to data transmission, machine-network interfaces, network-network interfaces and packet switching techniques, the study firstly starts with theoretical definitions and concepts before proceeding to the introduction of communication models and architectures. Secondly, data coding techniques are introduced and the communication channel is studied. Line coding and channel impairment effects on data transmission are tested and validate din laboratory. Thirdly error detection and correction as well as reliable transmission techniques and automatic repeat request protocols are detailed including flow control, ordering, segmentation and error recovery. These protocols are studied in laboratory using a network simulator. Finally commercially available implementations are studied and it is raised awareness and exchange of good practices regarding real network and protocol design and configurations to achieve the maximum performance
In order to qualify the student with the analysis, configuration and getting the adequate performance of data networks and protocols this subject has two main articulated components: Theoretical classes and programming laboratories. There are home and laboratory assessments and reports for the main theory chapters. Thus, group work as well as practicing outside of the class context is stimulated.

Assessment methods:

Theoretical lectures and lab practice using simulation tools (Matlab and NS2)
The grading of students is made of a combination of two written tests and continuous evaluation based on lab reports (on the completion of assignments in lab classes). Minimum grade is 8 on both tests and 10 on the lab reports evaluation. Final grade will consist of 60% of the average of the written tests and 40% of the lab reports. The theory component grade can also be obtained in a final exam as an alternative to the 2 written tests.

Language of instruction:	Portuguese / English

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Individual Course Units Syllabus

2nd Year – 2nd Semester

Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Maritime Machines**		
Field:	Thermal Instalations		
Course code:	923019	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Manuel Duarte Dias Mendes Nogueira		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Introduce students to the fundamental concepts of internal combustion engines, their driving and maintenance concepts. The basics of turbomachinery and volumetric machinery and their application to industrial and marine systems are also introduced, as recommended by the IMO-STCW Convention, as amended for training of Eletctrotechnical officers (Table A-III / 6).

Course contents:

1. Prime Movers, Including Main Propulsion Plant (14 hours)
2. Engine Room Auxiliary Machinery (16 hours)
3. Deck Machinery (14 hours)
4. PREPARATION OF CONTROL SYSTEMS OF PROPULSION AND AUXILIARY MACHINERY FOR OPERATION (15 hours)
5. Practical work/laboratory exercises

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:

Item 1.1.1 BASIC UNDERSTANDING OF THE OPERATION OF MECHANICAL ENGINEERING SYSTEMS – (44/102 hours)

Item 1.2.1 PREPARATION OF CONTROL SYSTEMS OF PROPULSION AND AUXILIARY MACHINERY FOR OPERATION – (15/15 hours)

Recommended reading:

Textos de Apoio à Unidade Curricular, Jorge Trindade, 2011.
J. Martins. Motores de Combustão Interna, Publindústria, 2005.
D. Giacosa. Motores Endotermicos. Ed. Dossat, 1979.
Marques, A., Turbomáquinas, ENIDH, 2011
Górski Z., Construction and operation of marine pumps. Trademar. Gdynia 2010
Górski Z., Construction and working of marine compressors, blowers and fans. Fundacja Rozwoju Akademii Morskiej w Gdyni. Gdynia 2006
Kossowski K., Introduction to the theory of marine turbines. Foundation for the Promotion of Marine Industry. Gdańsk 2005
Walsh P.P., Flether P., Gas turbine performance. Blackwell Publishing. Oxford 2004

Teaching methods:

The teaching will be carried out through practical classes, practices and laboratory. It is intended that through literature reading the student are introduced to each topic to be discussed. The practical classes will work with brief presentations on each topic, followed by practical examples, where is intended that student consolidate the concepts studied. Practical classes will be conducted by solving exercises where students apply the knowledge acquired. Some of these classes involve carrying out laboratory work, where the student can check the consistency of the models studied with the real problems.

Assessment methods:

Conducting laboratory work in group 2 (NTP);
Conducting two tests during the semester or one final exam (NE);
The final grade (NF) is the result of: NF = 0.3×NTP+0.7×NE.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Electrical Instalation**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923020	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Paulo Alexandre Rodrigues Chaves Ferreira		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The goal is provide students with the technical-scientific knowledge of electrical supply installations for ships and for industrial plants, in general, in low and medium voltage systems. They are advised to the safety standards and issues related to power quality and harmonic distortion caused by non-linear loads. Command, control and protection apparatus associated with electrical installations are referred. Knowledge about different sources of electricity, covering the conventional and alternative power sources. Emergency power supply systems, based on batteries and fuel cells are also referred.

Course contents:

1. **Basic parameters, processes and environment influences**
   Review the electricity distribution systems single-phase and polyphase. Neutral systems. Protection of people and electrical installations. Safety regulations and standards. IEC Standards and Technical Regulations of LV installations. Characterization of facilities regarding environment and electrical risks.
2. **Power sources and marine electrical equipment**
   Electrical power sources, conventional and alternative processes. Emergency power systems based on batteries and fuel cells. Load coefficient. Electrical devices for power distribution.
3. **Power Distribution boards**
   Electrical drive systems apparatus. Direct current and emergency circuits. Headlights switchboards. Power distribution on ships. Main switchboards, emergency switchboards.
4. **Electrical Devices for Power Distribution**
   Distribution switchboards, switchgear, circuit schematics, automatic circuit breakers, switches, contactors, protective relays.
5. **Power and data cables.**
   Characterization of electrical power cables, control cables and communication cables, nVoltage drop and dimensioning concerns. Networks for data communications. Distribution networks design.
6. **Three-phase non-linear and unbalanced systems.**
   Positive-sequence, negative-sequence and homopolar components. Power factor. Instant power on systems with non-sinusoidal quantities. Harmonic distortion (THD). Transients caused by network faults. Protection circuits. EMI noise and IEC standards. Shielding.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.5 ELECTRICAL POWER DISTRIBUTION BOARDS AND ELECTRICAL EQUIPMENT – (60/60 hours)
- 1.1.5.1 Basic parameters, processes and environment influences (14 hours)
- 1.1.5.2 Power distribution boards (12 hours)
- 1.1.5.3 Electrical Devices for Power Distribution (12 hours)
- 1.1.5.4 Cables (10 hours)
- 1.1.5.5 Other marine electrical devices (12 hours)

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Recommended reading:
Apontamentos dos docentes da unidade curricular. Regras Técnicas das Instalações de Baixa Tensão, Imprensa Nacional- Casa da Moeda. Redes de energia elétrica, uma análise sistémica, J. P. Sucena Paiva, IST Press, 2005. Damir Radan, Power Electronic Converters For Ship Propulsion Electric Motors, Department of Marine Technology, NTNU, Norway, 2004. Instalações Elétricas de Embarcações, DL 379/80.
Teaching methods:
Class will consist primarily of presenting fundamental physics, maths and engineering concepts through working problems, and discussing in-class demonstrations and case-studies. Key points will be highlighted by the choice of examples, which will be discussed in the context of power electrical circuit's theory and practice. Practical engineering applications, and results, are discussed in the context of the work.
Assessment methods:
Grading is based on individual written tests (usually 2) and several work reports. The final average will be Computed as follows: 60% will be from lecture tests, 40% from work reports. Each component must have a grade not less than 7 values. The final exam is comprehensive.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Computers Network**		
Field:	Computers and Digital Systems		
Course code:	923021	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Mário Jorge Simão Assunção		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

This course is intended to provide theory and practical knowledge to the students in computers networking and networks management.
The students will be capable to identify the several technologies in computers networks and structures in modern data networks. Also capable to implement computers networks between informatics devices, using the HUBs, Routers and Switch's configuration in OS and TCP/IP models.

Course contents:

1 – OSI and TCP/IP referential models review (2 hours)
Monolithic and layers networks architecture;
Communication protocols concepts;
Hierarchies on protocols. Addressing methods;
2 – Local networks technologies (16 hours)
Medium shared access control;
Computers local networks;
Networks segmentation
3 – Networks interconnection in IP protocol(22 hours)
The protocol IP (Internet Protocol);
Routing in IP networks.
4 – Network computerized systems of ship plant (30hours)
This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.5.3 BRIDGE-BASED, ENGINE-ROOM-BASED AND COMMERCIAL COMPUTER USE – (30/45 hours)

Recommended reading:

"Data and Computer Communications" - W.Stallings, 8th edition, 2007 - Pearson Prentice Hall
"Communications Networks - Fundamental Concepts and Key Architectures" - Alberto Leon-Garcia & Indra Widjaja, 2 edition, 2003 - McGraw-Hill
"Computer Networking A Top-Down Approach Featuring the Internet" – James F. Kurose and Keith W. Ross, 6 Edition, Pearson, 2013
"Engenharia de Redes Informáticas", Edmundo Monteiro, Fernando Boavida, 10ª edição, FCA editora 2011

Teaching methods:

Lectures and practical exercises are comprised to achieve the course objectives. Various mechanisms will be used to help us all achieve these goals and to evaluate our levels of success.

Assessment methods:

Final grade: 60% of thoeretical and 40& of practical
Theoretical component
Continuous assesement composed by two tests with the minimum assessment of 7units in each and the arithmetic mean of 9,5 units in 0 – 20 scale;
Or a Final exam with minimum assessment of 9,5 units in 0 – 20 scale.
Practical component
Laboratory works with minimum assessment of 9,5 units in 0 – 20 scale

Language of instruction:	Portuguese / English

Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Eletronics II**		
Field:	Electronics and Telecommunications		
Course code:	923022	**Type of course:**	Mandatory
From:	September 2019		
Year of study:	2º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Abel da Silva Simões		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Students are expected to achieve the competencies in the field of electronics advocated in STCW Sections A-III / 6, B-III / 6 and B-IV / 2 and IMO Model 7.08 Course, in particular with regard to: 1.1.4 - Fundamentals of electronics and power electronics.
The UC of Electronics II continues the contents of Electronics I, having as main objective the study of circuits (discrete and integrated) directly related to amplifiers, oscillators, filters in frequency, mixers, modulators and signal detectors and some other special devices. It aims to provide fundamental knowledge for the understanding of characteristic circuits of marine electronic equipment of the ship, with a greater emphasis on aids to navigation and communications

Course contents:

1. Topologies and Characterization of Amplifiers (18 hours)
- Classes of amplifiers
- RF Amplifiers
- FI and video amplifiers
- Audio amplifiers
- Power amplifiers
- Tuned amplifiers
- Feedback amplifiers
- Noise factor
- Stability of feedback amplifiers
- Automatic gain control circuits

2. Oscillators and signal generators (14 hours)
- Criterion of oscillation
- Sinusoidal oscillators: Wien Bridge; Oscillator by phase shift; Oscillator tuned by active filters; Oscillator of Hartley and Colpitts
- Multi-Stabilized, Bi-Stable, Monostable and Multivibrator Circuits
- Variable Frequency Oscillators and Synthesizers

3. Frequency response of circuits (14 hours)
- Transfer function
- Poles and zeros
- Bode Diagram
- Types of filters (low pass, high pass, bandpass and reject band) and selectivity
- Passive and active filters of 1st order
- Passive and active second order filters (bi-square sections - Sallen & Key)
- Approaches of Butherworth and Chebyshev

4. Mixers, Modulators and Detectors (8 hours)
- Heterodination of signals
- Topologies of mixers
- Super-heterodyne receptor
- Analog modulators in amplitude, frequency and phase.

- Digital modulators ASK, FSK, PSK
- Demodulators / Detectors
- Modulators / AM, modulation index, spectrum.
- Analog and Digital Signal Detector Circuits

5. Special RF electronic devices (6 hours)
- Microwave Oven
- Pulse modulator
- Optocouplers
- Sensors and Transducers

Recommended reading:

- Adel Sedra, Kenneth Smith, "Microelectronic Circuits, 4ª edição (recomendado) ", Oxford University P., 1997
- Albert Paul Malvino, Princípios da Eletrónica, Vol. I e II, 6ª Edição, 2000, Editora MacGraw-Hill
- António J. Gil Padilla, Eletrónica Analógica, Editora MacGraw-Hill de Portugal, 1993, Lda
- Berger H., Automating with STEP 7 in LAD and FBD: Simatic S7-300/400, SIEMENS
- Berger H., Programmable Controllers in STEP 7 Basic with SIMATIC S7-1200, SIEMENS
- Bird J., Electrical circuit theory and technology, Elsevier 2002
- Ellis Norman, Electrical interference handbook, Second edition, Publisher: NEWNES,
- McGeorge H. D., Marine electrical equipment and practice, Butterworth-Heinemann, Oxford 2004
- Whitaker J. C., Electronic systems maintenance handbook, Technical Press Morgan Hill, California, USA, 2002
- Technical documentation of ships devices and systems
- Manufacturers' manuals
- Manual and supporting texts – Abel Simões
- Perez T., Ship motion control, Springer-Verlag, London 2005
- Tetley L., Calcutt D., Electronic navigation systems. Elsevier, London 2001
- Electronic communications systems, Frank R. Dungan – 1993
- Electronic navigation systems, Laurence Tetley, David Calcutt, 2001
- The marine electrical and electronics bible, John C. Payne – 1998
- Performance Standards for shipborne radiocommunications and navigational equipment" ed. 2011
- Radar Handbook, Skolnik, Merrill
- Installation handbook of Furuno deep sea equipments, Furuno
- Pallás-Areny, Ramón; Analog signal processing. ISBN: 0-471-12528-8
- Taylor, Rosemary H.; Data acquisition for sensor systems. ISBN: 0-412-78560-9
- Manuel de Medeiros Silva; Circuitos com transistores bipolares e MOS. ISBN: 972-31-0840-2
- Manuel de Medeiros Silva; Introdução aos circuitos eléctricos e electrónicos. ISBN: 972-31-0696-5
- Abel Simões, Manual de Apoio, 2019

Teaching methods:

The theoretical classes consist of brief expositions about each theme, followed by examples, where the student is expected to consolidate the concepts.
In the practical classes will be the knowledge of the main devices and electronic circuits where the students will apply the acquired knowledge. The classes will involve the simulation, assembly, measurement and analysis of circuits and components, where the student must respond with the appropriate procedures and correct dexterity.

Assessment methods:

Continuous evaluation: 2 tests (T1 and T2); Practical and simulation work (TPS) and laboratory work (TL).
Laboratory presence is registered. For students less than 80% will be considered FAILED and for students less than 50% will be considered NOT ADMITTED.
Final score of continuous evaluation NFAC = (T1 + T2) / 2 * 0.6 + TPS * 0.2 + TL * 0.2 values, with the condition T1 and T2> 8 and (T1 + T2) / 2> 10 values and NFAC> 10 values.
For students admitted to the examination, the final evaluation grade: NFAE = Ex * 0.6 + TPS * 0.2 + TL * 0.2 values

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Industrial Instrumentation**		
Field:	Control and Automation		
Course code:	923023	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Mário Jorge Simão Assunção		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Treatment of electrical values generated by sensors, continuous or discrete, via signal conditioning.
Knowing the physical and electrical principles sensors.
Knowing final control elements of the process operating mechanism and establish the steps needed to convert a control signal on a proportional action on the process.

Course contents:

01. Introduction to instrumentation. (5 hours)

02. Conditioning analogue signals. (10 hours)

03. Conditioning digital signals. (15 hours)

04. Sensors and Transducers. (15 hours)

05. Integrated systems with sensor networks. (15 hours)

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.7 INSTRUMENTATION, ALARM AND MONITORING SYSTEMS – (45/45 hours)
Item 2.1.5 FUNCTION, CONFIGURATION AND PERFORMANCE TESTS OF MONITORING SYSTEMS, AUTOMATIC CONTROL DEVICES, PROTECTIVE DEVICES – (10/20 hours)

Recommended reading:

- Process Control Instrumentation Technology, Curtis D. Johnson, 6th Ed. Prentice Hall. (621 ACT/JOH).
- Electronic Instrumentation, Paul Regtien, 2nd Ed., VSSD.
- Principles of Electronic Instrumentation, Diefenderfer and Holton, Third Ed., 1994. (103/36).
- Instrumentation and Control Systems, Boyd and Jackson, fifth ed. Bloomsbury. (621 ACT/BOY)
- Instrumentação Industrial, Gustavo da Silva, Edição Escola Superior de Tecnologia de Setúbal, 1999. (103/95)
- Handbook of Modern Sensors Physics, Designs, and Applications - Jacob Fraden - Springer (Fourth Edition).

Teaching methods:

Classes consist of theory and practical exercises on the content of the course. For each content, theory will be addressed and then the problem solving methods. Teaching strategies and methodologies will be adopted in the classroom to promote active student participation in the construction of knowledge.
The aim is to enable students to understand and assimilate the theoretical basis of the program, and to have an awareness of the application of these bases to analyse and project monitoring systems based on transducers. Each new subject is introduced by a theoretical explanation of the topic, followed by the presentation of a series of theoretical and practical exercises. Students are encouraged to participate in solving exercises and solve

another set of exercises outside the classroom using literature, research and support given by the teacher outside the classroom. I tis then given an integrated approach to systems based on transducers and signal conditioning, with the goal of giving ability to develop small projects being done during class a draft of a computer simulation of the systems studied and encouraged their development outside the classes.
To initiate students in the study, analysis and design of systems based on transducers and signal conditioning within the program of the course of Industrial Instrumentation, we introduce the theoretical properties of thermoelectric materials, resistance variation with temperature, piezoelectric effect, electric and magnetic properties of materials, optical properties, light sources and their characteristics so that students can analyse and project monitoring systems of physical quantities by using the various types of transducers studied, and the respective signal conditioning. In this context, are also studied several types of signal conditioning circuits based on bridge circuits and operational amplifiers.

Assessment methods:

Continuous Assessment: Completion of two written tests during the class period, ranked0 to 20. The final grade will be the arithmetic average of scores in both tests. To pass you must have 9.5 as mean values of8 and minimum values in each test.
Final Exam: For students who do not pass the continuous assessment or for students who want to improve their grades. The approval will be obtained when the classification is equal to or higher than 9.5.

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Power Electronics**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923024	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	2º	**Semester:**	2º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	José Manuel Dores Costa		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

To give to the students the fundamentals of power electronics topologies and major semiconductors and reactive components. They are given the fundamentals of power DC-DC, DC-AC and AC-DC converters and switched mode power supplies. The intent is to provide the basic preparation for power electronics areas such as portable electronic equipment and motor and generator drives.

Course contents:

1.Reactive circuits review
Transient responses of 1st order and 2nd order networks, a review.

2. Mains frequency converters.
Rectifiers with inductive loads. Controlled rectifiers.
The rectifier diode and the thyristor (SCR).
Average and effective values.
Apparent power and active power. Power factor and harmonic distortion.
Three-phase converters. Soft-starters.

3. Switched mode power converters
Understanding switched circuit's efficiency.
Power converters: AC/DC, DC/AC, DC/DC and AC/AC.
Basic topologies of DC/DC converters. Bridge converters.
Converters with transformer.
PWM control. Continuous and discontinuous operation mode.
Voltage ratio.
Rectifiers with sinusoidal input current.
Power factor correction.
The MOSFET and IGBT Transistors, and Schottky diode.

4. Inverters
DC/AC single-phase bridge topologies.
Three-phase bridge converter.
Unipolar and bipolar voltage and current PWM control methods.
Total harmonic distortion (THD).

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.4 FUNDAMENTALS OF ELECTRONICS AND POWER ELECTRONICS – (15/45 hours)

Recommended reading:

Mohan, Undeland, Robbins, "Power Electronics: converters, applications and design", Wiley.
Bimal K. Boose, "Modern Power Electronics and AC drives", Prentice-Hall.
Manuel de Medeiros Silva, Circuitos com Transístores Bipolares e MOS, F.C. Gulbenkian.

Apontamentos dos docentes da UC.
Fichas laboratoriais dos docentes da UC.

Teaching methods:

Power Electronics CU intends to provide students with knowledge of power electronic converters, mainly those switched mode power topologies that are used in modern portable and distributed power systems, and in electric motors drives. Theoretical and practical subjects are divided into grid frequency commutated converters, and high switching frequency converters. Syllabus also includes semiconductors (SCR, transistors and diodes) reactive components (capacitors, inductors and high frequency transformers), control circuits and simulation software. Also noteworthy is the calculation of the conduction and switching losses, harmonic distortion and the converters design.
The teaching will be done through theoretical, practical and laboratory classes. The theoretical and practical classes are directed to the fundamental concepts, and theoretical exposition of the material, and the motivation for personal student's work. They also intent to comment the resolution of exercises. The laboratory is intended for experimental practical work, where the student can verify the compliance with the theory and to give the practical knowledge about switched mode power electronic circuits and linear power electronics circuits.
Subjects are exposed as a first approach for power converters in which basic topologies of power DC-DC and DC-AC converters, and control integrated circuits are referred. Classes are divided into theoretical and laboratory practical ones. The first is intended for theoretical exposition and for a critical resolution of typical and demonstrative problems related with each converter. Laboratory classes complement the theoretical exposition with experimental demonstrations about linear and switched mode converters. A practical guide is previously distributed to students describing the experimental work to be done. At the end, a concise report that must include the objectives, designed circuits, simulation and experimental results is then discussed and evaluated. Students must be able to understand power converters topologies and working principles, and to know the usual control circuits.

Assessment methods:

Grading is based on individual written tests (2) and several lab work reports which are mandatory.
The final average will be computed as follows: 60% will be from lecture tests, 40% from lab works. Each Component must have a grade not inferior to 7values.
The final exam is comprehensive.

Language of instruction:	Portuguese / English

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Individual Course Units Syllabus

3rd Year – 1st Semester

Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Auxiliar Systems**		
Field:	Thermal Instalations		
Course code:	923025	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Manuel Duarte Dias Nogueira		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Provide students with the application of previously acquired knowledge to the analysis of the functioning of existing auxiliary equipment aboard ships, as recommended by the Convention IMO-STCW and Amendments (Table A-III /6).

Course contents:

1. **Cargo Handling Systems (24h)**
2. **Hotel Systems (12h)**
3. **OPERATION OF ALL INTERNAL COMMUNICATION SYSTEMS ON BOARD (14 hours)**
4. **Maintenance and repair of electrical, electronic and control systems of cargo handling equipment (20h)**
5. **Practical/laboratorial work**

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.1 BASIC UNDERSTANDING OF THE OPERATION OF MECHANICAL ENGINEERING SYSTEMS – (36/102 hours)
Item 1.7.1 OPERATION OF ALL INTERNAL COMMUNICATION SYSTEMS ON BOARD – (15/15 hours)
Item 2.4.2 MAINTENANCE AND REPAIR OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS OF CARGO HANDLING EQUIPMENT – (20/20 hours)

Recommended reading:

Marques, A., Condutas válvulas e acessórios, ENIDH, 2011
Marques, A., Refrigeração, ENIDH, 2003
Marques, A., Permutadores de calor, ENIDH, 2003
Marques, A., Separação mecânica, ENIDH, 2003
Hewitt, G. F., Shires, G. F., Bott, G. L., Process Heat Transfer, CRC Press, 1994
Tubular Exchanger Manufacturers Association-TEMA, 1988Kategurov, M., Marine Auxiliar Machinery and Systems, Peace Publishers, 1980
Le Noveau Pohlmann - Manuel Technique do Froid, PYC Edition, 1991
Milton J. H., Leach R.M., Marine steam boilers. Butterworth Marine Engineering Series. London – Boston 1980
Jackson L. and Morton T.D., General engineering knowledge for marine engineers. 5th ed. London, Thomas Reed Publications Ltd 1990. (ISBN 0947 637.761)
Górski Z., Construction and working of marine heat exchangers. Fundacja Rozwoju Akademii Morskiej w Gdyni. Gdynia 2007

Teaching methods:

Lectures are taught to the students about pipes, valves, refrigeration and air conditioning, heat exchangers, centrifuges, auxiliary and hotel systems, including the characterization of the key components. In order to enable students to analyse these systems and to a better understanding of the devices and operating mode, are introduced marine engineering simulation programs. To consolidate the theoretical knowledge and sensitize students to the aspects of practical nature are made practical exercises in the laboratory.

The teaching will be carried out through practical classes, practices and laboratory. It is intended that through literature reading the student are introduced to each topic to be discussed. The practical classes will work with brief presentations on each topic, followed by practical examples, where is intended that student consolidate the concepts studied. Practical classes will be conducted by solving exercises where students apply the knowledge acquired. Some of these classes involve carrying out laboratory work, where the student can check the consistency of the models studied with the real problems. In order to enable students to analyse and solve problems related to the studied subject, the work required in this course is developed, articulately, on two levels: theoretical and practical classes. For each of the chapters presented in lectures, students perform practical tests in the laboratory and in simulator of marine machinery.
Assessment methods:
Conducting laboratory work in group 2 (NTP); Conducting two tests during the semester or one final exam (NE); The final grade (NF) is the result of: NF = 0.3×NTP+0.7×NE.

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Navigation and Communication Equipments**		
Field:	Electronics and Telecommunications		
Course code:	923026	**Type of course:**	Mandatory
From:	September 2019		
Year of study:	3º	**Semester:**	1º
ECTS:	5	**Hours/week:**	75 h TP
Name of lecturer:	Abel da Silva Simões		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

It is expected that students reach the competences of Table A-III / 6 of the STCW, for electro-technical officers, particularly in the maintenance and repair of bridge navigation equipment and ship's communication systems and equipment's. Also give some competences for integrated navigation systems, voyage data recorder and dynamic positioning system.
The curriculum follows the information required in the course of model 7:08 IMO, edition of 2014, to the formation of electro-technical officers:
Model Course 7.08 – ETO, 2014 Edition Competences
2.3.1 Maintenance and repair of bridge navigation equipment – (39/39 hours)
2.3.2 Maintenance and repair of ship communication systems – (15/15 hours)
1.5.3 Bridge based, engine room based and commercial computer use (12/45)
The program also fulfils the training leading to the certification of VHF radiotelephone Operator (Short Range Certificate).

Course contents:

Maintenance and repair of bridge navigation equipment – (39 hours)

Navigation basics
- Definition of navigation, basic terms and units of measurement
- Geodesics, reference systems and geographical coordinates
- Basic information on cartography and paper and electronic navigation charts
- Characterization of terrestrial, celestial, radar, radio, satellite, inertial navigation (Dead Reckoning).

Radars
- Theoretical Principles of Radar Operation
- Main blocks that make up the radars, on-board location, description of their function
- Block diagram showing the radar configuration on the bridge with Interswitch
- Diagnostic functions in the use of radar and troubleshooting
- Radar Performance Monitor
- Magnetron mounting and radar tuning
- Corrective and preventive maintenance of radar
- Definition, principle and terminology used in ARPA

Global Navigation Satellite Systems
- Basic knowledge of operation, maintenance and troubleshooting of Global Navigation Satellite Systems
- Principle of operation of Global Navigation Satellite Systems: GPS, GLONASS, Galileo
- Main components of the on-board GPS system and characterization of its functions
- DGPS system operation and accuracy comparison with GPS
- Connection of the GPS receiver with other navigation equipment, test of the output signals

Inertial Navigation System
- Basic knowledge of operation of the inertial navigation system

Compass, Gyrocompass and Gyrolaser equipment
- Basic knowledge of operation, maintenance and repair of the marine compass:
- Principle of operation, main components of the gyrocompass
- Synchronization process and errors of the gyrocompass
- Periodic maintenance of the gyrocompass and repeaters
- Modes of operation and main components of optical fiber (FOG) and gyro ring (RLG)
- Connecting the steering wheel with other navigation equipment
- Principles of operation and operation of the magnetic compass and main associated components

Marine Odometers
- Basic knowledge of construction, operation, maintenance and troubleshooting of various types of marine odometers:
- Doppler, electromagnetic, and pressure Odometers

Acoustic probe and Sonar
- Basic knowledge of construction, operation, configuration, maintenance and troubleshooting of sounding systems

Autopilot of ships
- Description of the principle of operation
- It shows the various modes of operation
- Examples of modern automatic pilots and their characteristics

Travel data recorders, navigation lights, search lights, ship horns and sound signal systems, anemometers and wind direction indicators
- Description and basic knowledge of operation and maintenance periodical travel data recorders
- Basic knowledge of operation, maintenance and repair of navigation control system and alarm system
- Basic knowledge of operation, maintenance and troubleshooting of visual search indicators and remote control system
- Basic knowledge of operation, maintenance and repair of ship horns and the sound signal control system

Maintenance and repair of ship communication systems (**15 h**)
- Basic knowledge of the frequency bands used in maritime communications and the propagation of electromagnetic waves
- Knowledge of block diagrams showing the main components of receivers and transmitters of radiocommunication equipment
- Description of various types of antennas used in maritime communications and their maintenance
- Description of disturbances and interferences which may affect the operation of ship communication systems
- Meaning of GMDSS with a description of its purpose and structure
- Brief description of the GMDSS systems and subsystems and their purpose, operation and maintenance: Inmarsat Sat C, NBDB telex terminal with MF / HF, DSC, NAVTEX, EPIRB, SART transceiver
- Description of the main and emergency power supply dedicated to the ship's communication systems, their maintenance and testing
- Description of the Inmarsat satellite communication system, its structure, scale, operation and maintenance
- Description of the Iridium satellite communication system, its structure, scale, operation and maintenance
- Description of the Automatic Ship Identification System (AIS), its structure, scale, operation, testing and maintenance
- Description of the Long Range Vessel Identification and Monitoring System (LRIT), its structure, scale, operation, testing and maintenance
- Description of the ship safety alert system (SSAS), structure, scale, operation, testing and maintenance

Bridge based, engine room based and commercial computer use (12h)
- Explains purpose, construction and functions of Integrated Navigation Systems
- Explains purpose, structure and functions of Voyage Data Recorder (VDR system)
- Explains purpose, structure and functions of Dynamic Positioning System

Training of Radiotelephone Operator in VHF (9h)
- General and operational procedures for maritime communications (RR)
- Communications in simulator of distress, urgency, safety and routine in DSC and R / T
- Simulator communications for search and rescue operations
- Communications in simulator for maritime safety (MSI)
- Use of the International Code of Signals (ICS) and maritime vocabulary (IMO)
- Use of documents and publications relating to maritime communications

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 2.3.1 Maintenance and repair of bridge navigation equipment – (39/39 hours)
Item 2.3.2 Maintenance and repair of ship communication systems – (15/15 hours)

Recommended reading:

- GMDSS Manual 2009. IMO Publishing, London 2009
- Manual for use by the maritime mobile and maritime mobile-satellite services, ITU Geneva 2011
- Fossen T., Marine control systems, Marine Cybernetics, Trondheim 2002
- Perez T., Ship motion control, Springer Verlag, London 2005
- Tetley L., Calcutt D., Electronic navigation systems. Elsevier, London 2001
- Manufacturers' manuals
- Advanced marine electrics and electronics troubleshooting, Edwin R. Sherman – 2007
- Electronic communications systems, Frank R. Dungan – 1993
- Electronic navigation systems, Laurence Tetley, David Calcutt, 2001
- Electronic troubleshooting, Daniel R. Tomal, Neal S. Widmer – 2003
- Global mobile satellite communication for maritime, land, and aeronautical, Stojče Dimov Ilčev, 2005
- High-Resolution Radar Second Edition, WEHNER, Donald R

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- Installation handbook of Furuno deep sea equipments, Furuno
- Marine electronic navigation, S. F. Appleyard, R. S. Linford, P. J. Yarwood - 1988
- Performance Standards for shipborne radiocommunications and navigational equipment" ed. 2011
- Radar Handbook, Skolnik, Merrill
- The marine electrical and electronics bible, John C. Payne – 1998
- The Motorboat Electrical and Electronics Manual, John C. Payne – 2002
- Understanding Radar, COLE, Henry W.
- Understandnig GPS Principles and Applications, KAPLAN, ELLIOTT D.
- Manuais e textos de apoio, Abel Simões
- IMO SafetyNET Manual
- IMO NAVTEX Manual
- Radio Regulations, Geneve, 2004, International Telecommunication Union
- Manual for Use by the Maritime Mobile and Maritime Mobile-Satellite Services
- Inmarsat Maritime Communications Handbook
- Admiralty List of Radio Signals. Volume 5 GMDSS. London: UKHO, 2009/10.
- Handbook for Radio Communications, Second Edition, G.D. Lees and W.G. Williamson, Lloyds of London Press, May 1996, ISBN 1-85044-472-2, Lloyds of London,
- Model course – Restricted Operator's Certificate for GMDSS, 2014 Edition
- GMDSS Faros Poseidon Simulator demonstration equipment and Manuals

Teaching methods:

Theoretical and practical lessons with the equipment. The lectures consist of brief presentations on each topic, followed by practical, where the student intends to consolidate the concepts. In practical classes, with the equipment will carry the knowledge of the functions and operation of each equipment where students apply the knowledge acquired. The classes involve exercises, where the student should respond with the correct procedures and appropriate skills to operate, test, repair and maintain the equipment.

Assessment methods:

Continuous assessment: 2 tests (T1 and T2) and practical work (TP)
There is a presence register in the practical classes. For students less than 80% will be considered Not Admitted to the exam.
Final score of continuous evaluation NFAC = (T1 + T2) / 2 * 0.7 + TP * 0.3 values, with the condition of T1> 8; T2> 8; TP> 10 and NFAC> 10 values.
The final mark of the exam NFE = NEx * 0.7 + TP * 0.3 values

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Control Systems**		
Field:	Controlo and Automation		
Course code:	923027	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	1º
ECTS:	6	**Hours/week:**	60 h TP
Name of lecturer:	Miguel Pedro Silva		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

This course aims that students achieve the following objectives, as recommended by the Convention IMO-STCW and Amendments:
- Identify and characterize control systems and its elements;
- Analyse and characterize the linear model of a physical systems in the frequency and time domains;
- Design and analyse control systems using root locus methods and frequency response methods (including Bode and Nyquist methods);
- Awareness of the performance limitations of all control systems
- Interpret diagrams of control systems;
- To analyse the functions, features and functionality of the control systems of machines, including the main propulsion plant.

Course contents:

Automation, Automatic Control Systems And Technology (20 hours)

Control methodologies (20 hours)

Function, configuration and performance tests of monitoring systems, automatic control devices, protective devices (10 hours)

Maintenance and repair of automation and control systems of main propulsion and auxiliary machinery (4 hours)

Maintenance And Repair Of Control And Safety Systems Of Hotel Equipment (6 Hours)

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.6 FUNDAMENTALS OF AUTOMATION, AUTOMATIC CONTROL SYSTEMS AND TECHNOLOGY (20/40 hours)
Item 1.5.1 MAIN FEATURES OF DATA PROCESSING – (5/45 hours)
Item 2.1.5 FUNCTION, CONFIGURATION AND PERFORMANCE TESTS OF MONITORING SYSTEMS, AUTOMATIC CONTROL DEVICES, PROTECTIVE DEVICES – (10/20) hours
Item 2.2.1 MAINTENANCE AND REPAIR OF AUTOMATION AND CONTROL SYSTEMS OF MAIN PROPULSION AND AUXILIARY MACHINERY – (4/30 hours)
Item 2.5.1 MAINTENANCE AND REPAIR OF CONTROL AND SAFETY SYSTEMS OF HOTEL EQUIPMENT – (6/30 hours)

Recommended reading:

Engenharia de Controlo Moderno - Katsuhiko Ogata; Pearson, Prentice Hall.
Control Systems Engineering - Norman S. Nise ; John Wiley & Sons, Inc.
Apontamentos da disciplina - Olímpia Ótão Pereira.

Teaching methods:

In order to initiate the students in the subject and contents of the "Control Systems" curricular unit, which focus on discrete and continuous control systems, some theoretical contents are introduced. The necessary principles will be taught allowing the students to analyse and characterize time and frequency domain physical systems, and design PID controllers. Also the state of the art will be presented, PID controllers, such as control methodologies and analytical tools (e.g., LGR and Bode Diagrams) and dedicated software (MATLAB with its toolbox Simulink). Some practical issues will be discussed in class, like the technology used (analogic and digital PID Controllers) in implementation of the previous control strategies and how can be used in nautical and industrial facilities.
Theoretical, practical e laboratorial classes. Theoretical classes will be followed by practical classes in which students will consolidate theoretical concepts. Practical e laboratorial classes will be used to problem solving and experimental verification of the controller design concepts.
In order to teach the students, how to analyse and design discrete and continuous control systems, as well as teaching how to implement and test those controllers in the labs, the course will be divided in three parts: theoretical, practical and laboratorial (lab) lectures. Theoretical lectures will be short and will be used to present brief explanations followed by solved exercises that will reinforce the knowledge being taught. In the practical lectures and in the laboratorial, exercises will be solved where students must apply and exercise the knowledge that they have learnt. In some of these lectures, lab work will be done where students will verify the coherence between the theory and the real events. The practical lectures and labs should be prepared in advanced, so individual and work group, during the lectures and during student's own studying time, is encouraged. This should prepare the students for finishing their work reports and to develop a critical analysis when solving problems.

Assessment methods:

There will be 4 to 6 laboratorial team work, but only three are due for delivery. There will be homework individual assignments (NPL);
Final test at the end of semester or final examination (NT);
Final grade (NF = 0.3 x NPL+0.7x NT).

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Microcontrollers**		
Field:	Computers and Digital Systems		
Course code:	923028	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	Victor Semedo Gonçalves		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The aim of this course is to teach the students microcontrollers structures, comparing the Harvard and Von Neumann architectures, and studying in detail two types of microcontrollers: the 8051 and the PIC microcontrollers. The main contained blocks of microcontrollers are to be described, as well as their instruction sets. The students will also be introduced to the usage of some development tools: simulators, debuggers and emulators.

Course contents:

Microcontroller architecture
– Notion of microcontroller
– Von Neumann and Harvard architectures
– RISC and CISC structures
8051 microcontroller family
– Block diagram
– Registers
– Interrupt structure
– Timing and event counter functions
– Serial port modes
– Pin-out description
– Memory mapping
– Addressing modes
– Instruction set
– Design and development software tools
– Programming
PIC microcontroller family
– Internal structure
– Interrupt structure
– Timing and event counter functions
– Serial data transmission: Serial port, I2C and SPI Protocols
– Pin-out description
– Instruction set
– Design and development software tools
– Programming

Recommended reading:

V. Gonçalves, Sistemas Eletrónicos com Microcontroladores, 2ª Edição, Ed. ETEP, LIDEL-FCA, ISBN 972-8480-12-1
V. Gonçalves, Sistemas Baseados em Microcontroladores PIC, Ed. Publindústria, ISBN 978972-8953-28-7

Teaching methods:

The teaching methodology that was adopted consists of theoretical presentations during which microcontrollers are portrayed and small-sized programs in which the different blocks are used are discussed, and lab practice in which the students test the programs they develop, controlling hardware structures and learning how to Master the tools that support those programs. The works of program analysis and design are launched in the theoretical classes and the students are expected to work in groups to prepare the laboratorial activities.
Assessment methods:
Theoretical lectures and lab practice The grading of students is made of a combination of two written tests and continuous evaluation based on lab reports (on the completion of assignments in lab classes). Minimum grade is 8 on both tests and on the lab reports evaluation. Final grade will consistof 70% of the average of the written tests and3 0% of the lab reports. The theory component grade can also be obtained in a final exam as an alternative to the 2 written tests.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Maritime Safety I**		
Field:	Technical Management		
Course code:	923029	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	1º
ECTS:	4	**Hours/week:**	60 h TP
Name of lecturer:	João Miguel Afonso Parente		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

The student should acquire the knowledge and skills to:
- To prevent and respond to emergency situations.
- Respond to requests for emergency planning and conducting search and rescue operations.
- Prevent, control and fight fires on the ship.
- To organize exercises and drills for firefighting training and fire fighting teams.
- Inspect and maintain operational detection means and fire fighting.
- To investigate fires and writing reports.
- Operate survival and rescue facilities.
- To organize exercises and drills to abandon ship and shipwreck recovery.
- Inspect and maintain operational abandonment means.
- Contribute to the safety of people and the ship.
- Survival at sea in case of abandonment.
- Be responsible for the conduct of survival and rescue boats, including fast rescue boats (theoretical).
- Use fireworks signs and emergency communications equipment.
- Know the obligations arising from the Convention, regulations and guidelines of the IMO as well as the National Legislation in the field of maritime safety.

Course contents:

1. Conventions, codes and regulations Inboard security organization. Emergency situations (Código STCW – Tabela A-VI/1-4) – 3 h

2. Prevention, detection and fire fighting, including operations (STCW Code - Table A-VI / 1-3) – 34 h

3. Abandonment of the ship and sea survival (STCW Code - Table A-VI / 2-1 A-VI / 2-2 A-VI / 1-1, A-VI / 1-4) – 14h

4. Security Personnel (STCW Code - Table A-VI / 1-4) – 9 h

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 2.4.3 ELECTRICAL AND ELECTRONIC SYSTEMS OPERATING IN FLAMMABLE AREAS – (15/15 hours)
Item 2.4.4 SAFETY AND EMERGENCY PROCEDURES – (5/5 hours)
Item 3.2 PREVENT CONTROL AND FIGHT FIRE ON BOARD
IMO Model Course No 2.03 and STCW 2010 Regulation VI/3 for Competence in Advanced Fire Fighting
Item 3.5 APPLICATION OF LEADERSHIP AND TEAMWORKING SKILLS
IMO Model Course No 1.39 – Leadership and Teamwork, and STCW 2010 Regulation III/6
Item 3.6.2 Knowledge of fire protection and ability to fight and extinguish fires (15h)
IMO Model Course No 1.20 Competence in fire prevention ans fire fighting, STCW 2010 code table A-VI/1-2

Recommended reading:

Apontamentos de Segurança Marítima I, J. Emílio, ENIDH, 2010.
International Safety Guide for Oil Tankers & Terminals, International Chamber of Shipping.
Storage and Handling of Petroleum Liquids, Hughes and Swindells, 3rd Ed., 1987.

Apontamentos de Segurança Marítima, A. Pais Lourenço, ENIDH.
A proteção contra incêndios em casas de máquinas de navios, M. Bouza Serrano, 1982.
SOLAS 1974-Protocolo 78 e posteriores Emendas (IMO)
ISM Code.
Code of safe working practices for the safety of merchant seamen, London.
Convenção e código STCW 95, emendas de 2010
RIM - Regulamento de Inscrição Marítima
Decreto-Lei 293/2001 (Regras sobre construção e equipamentos de Navios Passageiros e Embarcações de Passageiros de alta velocidade),
Decreto-Lei 180/2003 (Regras Normas Segurança Navios Passageiros),
Decreto-Lei 106/2004 (Aplicação da SOLAS, Protocolo e Emendas em vigor no ordenamento jurídico nacional)
Decreto-Lei 107/2004 (alterações as jangadas pneumáticas, embarcações socorro rápidas, MES e coletes de salvação em navios Ro-Ro).

Teaching methods:

This course aims to familiarize the student with the concepts, equipment and procedures used in this area, to obtain fundamental knowledge essential to the professional certification. Thus, the program addresses the fundamental topics of the discipline: mainly the prevention, detection and extinction of fires and other emergencies on board merchant ships, covering theoretical issues of subjects, including the equipment, materials and human resources on board and includes a set of exercises that simulate those situations.
The lectures will be accomplished through theoretical and practical classes. It is intended that through literature reading, the student is introduced to each topic to be discussed. The lectures will work with presentations on each topic, followed by practical examples, where is intended that the student could consolidate the studied concepts. In practical classes will be conducted exercises where students apply the knowledge acquired.
The objectives of the course are divided into two categories: the student must know the fundamentals of the issues presented, and should be able to apply them in real situations.
Thus, the work required in this course develops, articulately, on two levels: theoretical and practical exercises. The themes presented in the lectures are detailed in notes to support students so that they can properly assimilate the theoretical knowledge. In practical exercises the students have to face real situations in the training park, where the theoretical knowledge, organizational skills, leadership and teamwork are crucial.

Assessment methods:

The approval requires the continuous evaluation of cumulative satisfaction:
- 85 % in classes presence;
- All the practical exercises are mandatory and performed in class (note - EP);
- Individual work or group to perform mandatory (TIG);
- Rating greater than 7 at any values of theoretical tests and mean value of 9,5 (T) or final exame (E).

The final assessment (CF) is obtained with formula:

Continuous assessment:
CF = 0,3*EP+0,3*TIG+0,4*T

Final Exam:
CF = 0,3*EP+0,2*TIG+0,5*E

Language of instruction:	Portuguese / English

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Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**High Voltage Instalations**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923030	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	1º
ECTS:	6	**Hours/week:**	60 h TP
Name of lecturer:	José Manuel Dores Costa		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

To provide students with the technical and scientific fundamentals of high voltage (HV) electrical distribution systems on ships, and comparing them with general high voltage installations in industrial plants. Safety standards are referred to and the risks associated with high voltage installations on ships . Prepare students for the requirements of STCW 2010 in this area. Safety procedures as for isolation, isolation, and connection to ground are referred.
The student should understand the general characteristics of such an installation, and associated risks including production, distribution, transformation, and the safety standards for HV equipment operation. To refer the general aspects of the occurrence of electric circuits defaults and protection methods.

Course contents:

1. High Voltage Technology (15h)
Review of concepts of three-phase power distribution systems. Systems with grounded neutral. Normalized voltage values. Differences between LV and HV facilities. HV instalations and technology. Insulation demands. Characteristics of isolation and modular construction aspects

2. Safety Precautions and Technology (5h)
General constitution of a high voltage installation (HV) and electrical associated risks. Safety rules. Electrical switchboard and buses for HV facilities. Control components and equipment sectioning, isolation and protection of HV electrical installations.. Circuit breakers, vacuum and SF6 isolation. Protective relays. Fuses. Safety precautions.

3. Precaution required for high voltage systems operation (5h)
Isolation of voltage alive parts. Minimum safety distances for isolation. Ground connections. Insulation resistance measurement. Arcing and associated risks.
Strategies for sectioning and insulation of the components. Insulation resistance tests, and polarization index. Mass resistance and limiting current.

4. High Voltage transformers station (10h)
Power transformers. Dry-type, and oil-type transformers. Star and Delta connections. Of the windings. Transformer maintenance. Measures HV equipment.

5. High voltage cabling (5h)
HV cables insulation characteristics. Allowed working temperatures, and corrective factors in the cable array. Cable shielding.
Admissible currents on cables, and busbars. Corrective temperature factors.
Description and fault analysis. Earth faults. Short circuits and its consequences. Prevention and protection against overloads and short-circuits. Calculation of short-circuit current.

6. Safe Operation and Maintenance of High-Voltage Systems (12h)
Operation and maintenance of HV facilities. Division, isolation and ground connection. Voltage detection. HV apparatus.
Shore power systems.
IEC Standards and Technical Regulations for HV facilities.

7. Switchboards and Distribution Panels (6h)
HV and LV switchboards and distribution power panels. Coupling and breaking connections.

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This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.11 APPRECIATIONS OF THE HAZARDS AND PRECAUTIONS REQUIRED FOR THE OPERATION OF POWER SYSTEMS ABOVE 1,000 VOLTS – (5/5 hours)
Item 1.3.2 COUPLING AND BREAKING CONNECTION BETWEEN SWITCHBOARDS AND DISTRIBUTION PANELS – (6/6 hours)
Item 1.4.1 High Voltage Technology (15/15 hours)
Item 1.4.2 Safety Precautions and Technology (5/5 hours)
Item 1.4.4 Safe Operation and Maintenance of High-Voltage Systems (12/12 hours)

Recommended reading:

Apontamentos dos docentes da unidade curricular.
Regras Técnicas das Instalações de Média Tensão.
J. P. Sucena Paiva, Redes de energia elétrica, uma análise sistémica, IST Press, 2005.
Manuel Delgado, Sistemas Eléctricos Trifásicos de Média, Alta e Muito Alta Tensão, Publindústria, 2010.
Normas IEC, BS e outras aplicáveis a navios.

Teaching methods:

To obtain new competences and knowledge, understanding and proficiency, students must be highly qualified concerning electrical HV installations on modern ships. Safe operation of many sophisticated today ships is greatly dependent on skills and knowledge of electrical engineering fields used on-board of such ships. HV installations should be maintained and operated by competent and well prepared persons. The syllabus of this curricular unit intents to follow STCW 2010 requirements for ETO duties in HV installations. It starts with basic issues, and general description of a high voltage installation, and evolves to more detailed concepts to justify safe operation and maintenance procedures of HV facilities.
The aim in this course is to provide students with fundamental knowledge of high-voltage (HV) for onboard marine facilities for production, distribution, and to supply electric drives of the propeller electrical motors. Thus, the syllabus addresses the description and operation of the HV equipment, the control circuit analysis, opening, protection, and isolation of HV circuits. It also addresses safety rules to work on such plants on ships, accordingly to STCW2010 requirements.
The teaching will be done through theoretical and practical classes. The theoretical component is intended to introduce the basic theoretical concepts, equipment description, and for the motivation of the students. The practical component is intended to solve problems and review of typical practical situations, some laboratorial experiences, and plant simulations with computer software as well.
Students are encouraged to read several technical publications on program topics and to review the materials presented in class.

Assessment methods:

Conducting written tests throughout the semester , usually 2 or 1 final exam (NE).
Practical work and group monographs (NTP) .
The final grade (NF) is the result of : NF = 0.4NTP + 0.6NE .
Minimum grade of components: 7 points .

Language of instruction:	Portuguese / English

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Individual Course Units Syllabus

3rd Year – 2nd Semester

Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Electrical Systems Maintenance**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923031	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	2º
ECTS:	6	**Hours/week:**	60 h TP
Name of lecturer:	Mário Jorge Simão Assunção		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Aims to provide students with theoretical and practical knowledge in maintenance management and technical maintenance of equipment and systems that fall within the maritime sector and in the industrial sector in general.
It is intended that the student achieve the following competencies: Understand and describe the concepts and types of maintenance; Identify the various types of failure and strategies and appropriate work maintenance; To propose the application of new concepts in developing a maintenance plan; Ability to insert, organize and/or managing a maintenance department in a company.
The student will be able to use tools and instruments to identify various types of electrical failure and define maintenance strategies and maintenance work appropriate in each case. Be able to do proper maintenance management.

Course contents:

1. MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEM EQUIPMENT, SWITCHBOARDS, ELECTRIC MOTORS, GENERATOR AND DC ELECTRICAL SYSTEMS AND EQUIPMENT (20 hours)

2. DETECTION OF ELECTRIC MALFUNCTION, LOCATION OF FAULTS AND MEASURES TO PREVENT DAMAGE – (10 hours)

3. MAINTENANCE AND REPAIR OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS OF DECK MACHINERY (15 hours)

4. MAINTENANCE AND REPAIR OF CONTROL AND SAFETY SYSTEMS OF HOTEL EQUIPMENT (15 hours)

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 2.1.2 MAINTENANCE AND REPAIR OF ELECTRICAL SYSTEM EQUIPMENT, SWITCHBOARDS, ELECTRIC MOTORS, GENERATOR AND DC ELECTRICAL SYSTEMS AND EQUIPMENT – (20/20 hours)
Item 2.1.3 DETECTION OF ELECTRIC MALFUNCTION, LOCATION OF FAULTS AND MEASURES TO PREVENT DAMAGE – (10/10 hours)
Item 2.4.1 MAINTENANCE AND REPAIR OF ELECTRICAL, ELECTRONIC AND CONTROL SYSTEMS OF DECK MACHINERY – (15/15 hours)
Item 2.5.1 MAINTENANCE AND REPAIR OF CONTROL AND SAFETY SYSTEMS OF HOTEL EQUIPMENT – (15/30 hours)

Recommended reading:

"Organização e Gestão da Manutenção" – José Saraiva Cabral, Segunda Edição – Ed. Lidel. (B - Cota 146/10)
"Gestão da Manutenção" – Colecção o Gestor – 1994 IAPMEI (B – Cota 146/12)
"Powerboater's Guide to Electrical Systems Maintenance troubleshooting, and improvements", Edwin Sherman, 2nd Ed, 2007 Mcgraw-Hill
"Electrical equipment handbook: troubleshooting and maintenance", Kiameh Philip., McGraw-Hill Professional; ISBN: 978-0071396035

Teaching methods:

To initiate students in the study of this course, introduce knowledge is related to maintenance and maintenance methods and the need for operational equipment in terms of management and economic. Aiming to qualify for the importance of these themes presents different theories and different studies with the respective impacts. To consolidate the knowledge reported and sensitize students to some practical issues related to the maintenance approach is also different technologies and concepts for scheduled maintenance.
Teaching strategies and methodologies will be adopted in the classroom to promote student's active participation in the construction of knowledge. This is done through planned activities and structured according to the type of school (theory and practice / practice).
Aiming to enable students on the importance of the maintenance, meets up a work program that develops the theoretical and practical teaching and presentation of case studies. Are conducted theoretical tests and individual and group work. Thus, it encourages the individual and group work outside the classroom context.

Assessment methods:

The evaluation will be done in practical classes.
- Theoretical component (among two ways):
Continuous assessment consisting of two written tests with a minimum score of 7.5 in each and average less than 9.5.
A final exam with a score equal to or greater than 9.5.
- Practical component:
Conducting group work under the theme of maintenance.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Electrical Propulsion Systems**		
Field:	Electrotechnology and Electrical Machines		
Course code:	923028	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	1º
ECTS:	5	**Hours/week:**	60 h TP
Name of lecturer:	José Manuel Dores Costa		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

To provide students with the technical and scientific foundations of modern electric propulsion systems on ships. It refers to the configuration of a system of this type and describes the components of diesel- electric propulsion systems on modern ships.
Are analyzed electronic power converters to control the speed and torque of the different types of electric motors for propulsion high voltage which are also referred.

Course contents:

1. Diesel-electric propulsion systems: power diagrams and auxiliary machinery. (15h)

2. Different type of electric motors used for propulsion. (15h)
   Induction Motors. Doubly-fed wound rotor induction motors. Synchronous motors with permanent magnets, and exciter controlled. Speed and torque control of the electric motors. Comand and protective equipment.

3. Electronic drives, and electronic power converters. (24h)
   Commutated converters at mains frequency and high-frequency switching converters. Votage inverters . Three-phase bridge inverters. Phase Control and sinusoidal PWM control. AC and DC motor drives

4. Alternators running in parallel and electric load share. (6h)
   High-voltage systems. Frequency control, and voltage control of the alternators. Electrical power management onboard.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.3.1 COUPLING, LOAD SHARING AND CHANGING OVER GENERATORS – (6/6 hours)
Item 1.4.3. ELECTRICAL PROPULSION OF THE SHIPS, ELECTRICAL MOTORS AND CONTROL SYSTEMS (15/15 hours)

Recommended reading:

Apontamentos do docente da UC.
A.A. Debonos: "Modern Trends in Marine Electrical Propulsion and Transmission Systems", Proceedings of International Conference on the Naval Technology for the 21st Century, Hellenic Naval Academy, pp. 37-42, 29-30 June 1998, Piraeus (Greece).
B.K. Bose, Power Electronics and Variable Frequency Drives: Technology and Applications, IEEE Press, New York1, 1997.
Damir Radan, *Power Electronic Converters For Ship Propulsion Electric Motors*, Department of Marine Technology, NTNU, Norway, 2004.

Teaching methods:

To get new skills and to have the knowledge up to date, to understand new solutions and have proficiency, students must be highly qualified on electrical installations used onboard modern ships. The safety of many of

today's sophisticated vessels is very dependent on the skills and knowledge in various electrical engineering fields used in such vessels. The diesel- electric propulsion must be maintained and operated by competent and well prepared people. The program of this course intends to follow the 2010 STCW requirements for the functions of ETO on board. It starts with basic and descriptive questions about the general constitution of an electric propulsion installation, after evolving for more detailed concepts on the drive equipment of the engines.
The teaching will be done through theoretical and practical classes. The theoretical component is intended to introduce the basic theoretical concepts, equipment description, and for the motivation of the students. The practical component is intended to solve problems and review of typical practical situations, some laboratorial experiences, and plant simulations with computer software as well.
Students are encouraged to read several technical publications on program topics and to review the materials presented in class.
The aim in this course is to provide students with fundamental knowledge of marine facilities for ship electrical propulsion, and the drive and control of the electric motors of the propellers. Thus, the program addresses the operation of electrical equipment and machinery, control circuits, isolation and protection, and manipulation of the electrical motors. It also addresses the safety rules for handling such plants on ships according to STCW2010 requirements.

Assessment methods:

Conducting written tests throughout the semester, usually 2 or 1 final exam (NE).
Practical work and group monographs (NTP).
The final grade (NF) is the result of: NF = 0.4NTP + 0.6NE .
Minimum grade of components: 7 points.

Language of instruction:	Portuguese / English

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Maritime Automation**		
Field:	Control and Automation		
Course code:	923033	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	2º
ECTS:	6	**Hours/week:**	75 h TP
Name of lecturer:	Luis Filipe Baptista		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Introduce the fundamental concepts of logic circuits most used in maritime installations. Special focus is given to the pneumatic, oil-hydraulic, electric and electronic technologies. Provide the students with analysis and synthesis methods to project and develop both combinatorial and sequential circuits.
Introduce the students to the basic programming concepts of Programmable Logic Controllers (PLC), according with IMO-STCW Convention and amendments (Table A-III/6).

Course contents:

1. **FUNDAMENTALS OF AUTOMATION, AUTOMATIC CONTROL SYSTEMS AND TECHNOLOGY (20 hours)**
2. **ELECTRO-HYDRAULIC AND ELECTRO-PNEUMATIC SYSTEMS (16 hours)**
3. **MAINTENANCE AND REPAIR OF AUTOMATION AND CONTROL SYSTEMS OF MAIN PROPULSION AND AUXILIARY MACHINERY (20 hours)**
4. **MAINTENANCE AND REPAIR OF CONTROL AND SAFETY SYSTEMS OF HOTEL EQUIPMENT (8 hours)**

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 1.1.6 FUNDAMENTALS OF AUTOMATION, AUTOMATIC CONTROL SYSTEMS AND TECHNOLOGY (20/40 hours)
Item 1.1.10 ELECTRO-HYDRAULIC AND ELECTRO-PNEUMATIC SYSTEMS – (16/16 hours)
Item 2.2.1 MAINTENANCE AND REPAIR OF AUTOMATION AND CONTROL SYSTEMS OF MAIN PROPULSION AND AUXILIARY MACHINERY – (26/30 hours)
Item 2.5.1 MAINTENANCE AND REPAIR OF CONTROL AND SAFETY SYSTEMS OF HOTEL EQUIPMENT – (8/30 hours)

Recommended reading:

Apontamentos de Automação, Luís F. Baptista, E.N.I.D.H, 2014
Transparências das aulas de Automação, Luís F. Baptista, E.N.I.D.H, 2014
Industrial Automation-Circuits, Design and Components, David W. Pessen, John Wiley and Sons, 1989.
Método sequencial para automatização electro-pneumática, José Novais, Fundação Calouste Gulbenkian.
Bolton W., Programmable Logic Controllers, NEWNES: ISBN: 978-0750681124
Fossen T., Marine control systems, Marine Cybernetics, Trondheim 2002
Love J., Process automation handbook, Springer 2007
Smith R. G., Application of automatic machinery and alarm equipment in ships, Institute of Marine Engineers; ISBN: 0900976152
Berger H., Automating with STEP 7 in LAD and FBD: Simatic S7-300/400, SIEMENS

Teaching methods:

Initially, lectures are taught about automation technology, including the characterization of key components. In order to enable them to analyse control circuits and to a better understanding of

the devices are introduced some simulation programs, to analyse various examples and exercises. To consolidate the theoretical knowledge and sensitize students to the practical aspects of automation, several practical exercises are performed in the laboratory. The teaching methodology includes theory-practice lectures and laboratories. In theory-practice lectures, students will discuss the previously read concepts and project automated installations. In laboratories, the students will apply and discuss the application of the different theoretical concepts to a series of practical examples, mainly using laboratory equipment. Aiming to empower students to both analyse how to solve problems concerning the subject studied, the work required in this course develops, articulately, on two levels: theoretical and practical lectures. For each of the chapters presented in lectures, are designed exercises to be implemented in practical laboratory classes. In addition to these records, regular exercises to be done at home and that should be discussed in group are suggested.
Assessment methods:
7 group laboratorial exercises where students apply the fundamental concepts lectured in the theoretical classes Oral discussion about the lab reports (NL): minimal grade (9,5 points in scale 0-20 points) 2 tests during the semester or 1 final exam (NE): minimal grade in each test (7 points) The final score (NF) is obtained by: NF = 0.4xNL+0.6xNE.

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Maritime Safety II**		
Field:	Technical Management		
Course code:	923034	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	2º
ECTS:	5	**Hours/week:**	75 h TP
Name of lecturer:	João Miguel Afonso Parente		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Provide basic training in personal survival techniques and skills for survival and rescue boats. To enable students with the knowledge and practical training to survive in the sea, acting as a competent crew member of survival and rescue boats (including fast rescue boats) and command survival craft and rescue (including fast rescue boats) in accordance with the requirements of the tables A-VI / 2-1 A-VI / 2-2 and A-VI / 1-1 of the Convention IMO-STCW and Amendments.
Training in ship security aims to enable graduates with the necessary skills to perform the specific duties assigned by the Ship Security Plan, including activities related to the fight against piracy and armed robbery, in accordance with Chapter XI requirements -2 of SOLAS 74, as amended, of the ISPS Code, and table A-VI / 6 of the Convention IMO-STCW and Amendments.
Provide basic training on oil tankers, chemicals, liquefied gas and on other ships with particular characteristics. Raising awareness of the regulatory, legislative and administrative safe operation of ships, as advocated by the Convention IMO-STCW and Amendments.
Know the matters of maritime communications for radiotelephone operator of class A.

Course contents:

1. Survival at Sea (STCW Code - Table A-VI / 1-1 and A-VI / 2-1) – 8 hours

2. Survival and rescue boats (STCW Code - Table A-VI / 2-1 and A-VI / 2-2) – 18- hours

3. Fast Rescue Boats(Código STCW – Tabela A-VI/2-2) – 10 horas

4. Awareness and qualification for the exercise of specific functions Ship Security (STCW Code - Table A-VI / 6) – 7 hours

5. Oil tankers, chemical and liquefied gas (STCW Code - Table AV / 1) – 25 hours

6. Anti-pollution procedures and associated equipment (STCW code – Table A-V/1, A-III/1 e A-III/6) – 7 hours

7. Maritime Communications (VHF radiotelephone operator of class A) – 10 hours

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 3.1.2 ANTI-POLLUTION PROCEDURES AND ASSOCIATED EQUIPMENT – (8/8 hours)
Item 3.3 OPERATE LIFE-SAVING APPLIANCES (32 hours)
IMO Model Course No 1.23 and STCW 2010 Regulation VI/2, Table A-VI/2-1 for Competence in Survival Craft and Recsue Boats other than Fast Rescue Boats
Item 3.6.1 CONTRIBUTE TO THE SAFETY OF PERSONNEL AND SHIP (14h)
IMO Model Course No 1.19 and STCW 2010 Regulation A-VI/1-1

Recommended reading:

Apontamentos da disciplina.

SOLAS 1974-Protocolo e posteriores Emendas (IMO)
"Life Saving Appliances" (LSA Code) – IMO London.
"Tanker safety Guide" – International Chamber of Shipping – London 78
"IMDG Code" – IMO London.
"ISM Code" – IMO London.
Bo, Olav. Basic Safety Course: Sea Safety and Survival. Norwegian University Press, 1987.
Wright, C.H. Survival at Sea: The Lifeboat and Liferaft. Liverpool: The James Laver Printing Co. Ltd., 1986.
C.H. Wright, Proficiency in Survival Craft Certificates (Glasgow, Brown, Son and Ferguson, 1988)
D.J. House, Marine Survival and Rescue Systems (London, Witherby & Co. 1997)
International Chamber of Shipping (2003) - Maritime Security: Guidance for Ship Operators on the IMO International Ship and Port Facility Code. London. ICS.
I.L.O. (2003) - Seafarer's Identity Documents Convention (No. 185).
I.M.O (2003) - International Ship & Port Facility Security (ISPS) Code. London. IMO.
I.M.O (2010) - Seafarers Training, Certification and Watchkeeping (STCW) Code. London. IMO.
I.M.O (2009) - "Guidance to Shipowners and Ship Operators, Shipmasters and Crews on Preventing and Suppressing Acts of Piracy and Armed Robbery Against Ships". MSC.1/Circ.1334
Maritime Communications and IMO SMCP, 2001
International Telecommunication Union, Radio Regulations, Geneve, 2004

Teaching methods:

This course aims to familiarize the student with the concepts, equipment and procedures associated with this area, to obtain fundamental knowledge essential to the professional certification. Thus, the program addresses the fundamental topics of the discipline, mostly survival at sea but also characteristics and specific procedures for tankers, covering theoretical aspects of equipment's, resources and human behaviour on board and including a set of exercises that simulate those situations.
The objectives of the course are divided into two categories: the student must have a solid theoretical level on all the subjects covered, and should be able to apply them in real situations.
Thus, the work required in this course develops, articulately, on two levels: theoretical and practical exercises. The subjects presented in the lectures are detailed in notes to support students so that they can properly assimilate the theoretical knowledge. In the exercises of survival at sea students put into practice the theoretical knowledge through training in the swimming pool, at sea, on board two boats and, for existing procedures and equipment on tankers, through simulation on PC. In all cases, knowledge, organizational skills and leadership, and work group are decisive.

Assessment methods:

The teaching will be done in theoretical-practical classes. Statements will be made with equipment and training in survival craft and rescue boats as well as in fast rescue boats. In practical demonstration classes will be using and training with personal protection equipment. This will be used in the laboratory and workshop. Basic training in simulator of load and discharge cargo operations with tankers (VLCC, Product Carrier, LPG and CHT) will be executed by students. Laboratory tests will be made for use, testing and calibration of gas measuring equipment and training with chemical protective suits.

The approval requires the continuous evaluation of cumulative satisfaction:

- 85 % in classes presence;
- All the practical exercises are mandatory and performed in class (note - EP);
- Individual work or group to perform mandatory (TIG);
- Rating greater than 7 at any values of theoretical tests and mean value of 9,5 (T) or final exame (E).

The final assessment (CF) is obtained with formula:

Continuous assessment:
CF = 0,3*EP+0,3*TIG+0,4*T

Final Exam:
CF = 0,3*EP+0,2*TIG+0,5*E

Language of instruction:	Portuguese / English

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Escola Superior Náutica Infante D. Henrique
Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Psicossociology**		
Field:	Technical Management		
Course code:	923035	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	2º
ECTS:	4	**Hours/week:**	30 h TP
Name of lecturer:	Sérgio Tomé		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

On completion of the course the students should be able to demonstrate sufficient understanding, knowledge and competence to:

- Assist passengers in emergency situations (crowd management) on board passenger ships, in accordance with section A-V/2, paragraph 3 of the STCW Code;
- Provide direct service to passengers in passenger spaces, in accordance with section A-V/2, paragraph 2 of the STCW Code;
- Lead and work as a team on carrying out the duties of officer on watch, as listed in table A-II/1 of the STCW Code;
- Contribute to effective communications and human relationships onboard, understand and take necessary actions to control fatigue, as described in table A-VI/1-4 of the STCW Code.

Course contents:

1. FAMILIARIZATION WITH PASSENGER SHIPS (1h)
General design and arrangement. Operational limitations. Safety equipment. Legislation, codes and agreements.

2. PASSENGER SHIP CROWD MANAGEMENT - STCW A-V/2 (7h)

2.1 Shipboard emergency plans and procedures (3h)
Shipboard emergency plans, instructions and procedures related to the management and evacuation of the passengers. Crowd management techniques and relevant equipment to be used to assist passengers in an emergency situation. Muster lists and emergency instructions.

2.2 Assisting passengers en route to muster and embarkation stations (2h)
Give clear reassuring orders. Managing passengers in corridors, staircases and passageways. Maintaining escape routes clear of obstructions. Evacuation of disabled persons and persons needing special assistance. Searching of accommodation and public spaces. Disembarking passengers, with special attention to disabled persons needing assistance.

2.3 Mustering procedures (2h)
The importance of keeping order. Procedures for reducing and avoiding panic. Passenger lists for evacuation counts. The importance of passengers being suitably clothed as far as possible, when mustering. Checking that the passengers have donned their lifejackets correctly.

3. SAFETY TRAINING FOR PERSONNEL PROVIDING DIRECT SERVICE TO PASSENGERS IN PASSENGER SPACES - STCW A-V/2 (4h)

3.1 Communication with passengers during an emergency (2h)
Language or languages appropriate to the principal nationalities of passengers carried on the particular route. Use of elementary English vocabulary for basic instructions. Communicate during an emergency by some other means. Extent of safety instructions provided. Languages in which emergency announcements may be broadcast during an emergency or drill.

3.2 Life-saving appliances (1h)

Demonstration to passengers the use of personal life-saving appliances.

3.3 Embarkation procedures (1h)
Embarking and disembarking passengers, with special attention to disabled persons and persons needing assistance.

4. LEADERSHIP AND TEAMWORK - STCW A-III/1 (14h)

4.1 Shipboard personnel management and training (4h)
Shipboard structure and organization. Cultural awareness. Human error, automation awareness, complacency and boredom. Leadership and teamwork. Shipboard training.

4.2 International Maritime Conventions and recommendations, and national* legislation *(1h)
Human factor and marine accidents. International maritime conventions. Recommendations and national legislation.

4.3 Task and workload management (3h)
Planning and co-ordination. Personnel assignment. Time and resource constraints. Prioritization. Workloads, rest and fatigue.

4.4 Effective resource management (4h)
Allocation, assignment and prioritization of resources. Effective communication onboard and ashore. Decision-making reflecting team experience. Assertiveness and leadership, including motivation. Obtaining and maintaining situational awareness. Appraisal of work performance.

4.5 Decision-making techniques (2h)
Situation and risk assessment. Identify and consider generated options. Selecting course of action. Evaluation of outcome effectiveness. Decision making and problem solving techniques. Authority and assertiveness.

5. SOCIAL RESPONSIBILITIES – STCW A-VI/1-4 (4h)

5.1 Communication on board.

5.2 Human relationships on board.
Interpersonal relationships, teamwork, social responsibilities - rights and obligations of the crew, employment conditions, drugs and alcohol, health and hygiene on board.

5.3 Fatigue.

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 3.5 APPLICATION OF LEADERSHIP AND TEAMWORKING SKILLS (16h)
IMO Model Course No 1.39 – Leadership and Teamwork, and STCW 2010 Regulation III/6
Item 3.6.4 Knowledge of personel safety and social responsability (14 horas)
IMO Model Course No 1.21 – Competence in personel safety and social responsability, STCW code table A-VI/1-4

Recommended reading:

- Bass, B.M. (1990) *Bass and Stodgill's Handbook of Leadership.* (Third Edition). London: The Free Press.
- Flin, R. (1996) *Sitting in the Hot Seat. Leaders and Teams for Critical Incident Management*. Chechester: John Wiley & Sons
- Flin R., O'Connor, P. & Crichton, M. (2008). *Safety at the Sharp End: A Guide to Non-Technical Skills*. Aldershot: Ashgate Publishing Limited.
- I.L.O. (2006). *Maritime Labour Convention 2006*. International Labour Organization.
- I.L.O. (1996). *Accident Prevention on Board Ship at Sea and in Port: an ILO Code of Practice*. (2nd edition). Geneva: International Labour Office.
- I.M.O. (2014). *International Convention for the Safety of Life at Sea, 1974.* (Consolidated Edition 2014). London: International Maritime Organization.
- I.M.O. (2017). *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)*, 2017 edition. London: International Maritime Organization.
- I.M.O. (2010). *International Safety Management (ISM) Code and Guidelines on the Implementation of the ISM Code*. London: International Maritime Organization.
- I.M.O. (2000). *Model Course 1.28: Crowd Management, Passenger Safety and Safety Training for Personnel Providing Direct Services to Passengers in Passenger Spaces*. London: International Maritime Organization.

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- I.M.O. (2014). *Model Course 1.39: Leadership and Teamwork.* London: International Maritime Organization.
- Jeffery, R. (2007). *Leadership Throughout.* London: The Nautical Institute.
- Maritime & Coastguard Agency (2014). *Leading for Safety. A Practical Guide for Leaders in the Maritime Industry.* London: The Stationery Office.
- Maritime & Coastguard Agency (2010). *The Human Element: A Guide to the Human Behaviour in the Shipping Industry.* London: The Stationery Office.
- Maritime & Coastguard Agency (2015). *Code of Safe Working Practices for Merchant Seaman*. Norwich: Maritime Coastguard Agency.
- MSC Circ. 735 . *Recommendations on the Design and Operation of Passenger Ships to Respond to Elderly and Disabled Person's Needs*. International Maritime Organization.
- MSC Circ. 1014. *Guidelines on Fatigue and Management*. International Maritime Organization.
- MSC Res A 890(21) & Res A 955(23): *Principles of Safe Manning and Amendments*. International Maritime Organization.
- Reason, J. (1990). *Human Error*. Cambridge: Cambridge University Press.
- Res. A 770(18). *Minimum Requirements for Personnel Nominated to Assist Passengers in Emergency Situations on Passenger ships*. International Maritime Organization.

Teaching methods:

This course unit has 30 contact hours (108 hours total). The classes are theoretical-practical, with theoretical exposition, demonstration, practice and discussion of the subjects. Videos are presented and discussed with the students. The students make written works (group or individual) with oral presentation.

Assessment methods:

The evaluation of this course unit is done by one written test without consultation and one written group work with oral presentation, whether in continuous assessment or final exam:

a) Continuous assessment:

TP mark = Cont. assessment (20%) + written test (40%) + written work with oral presentation (40%)

b) Final exam:

TP mark = written test (50%) + written work with oral presentation (50%)

The students who have not gotten a grade lower than 10 (ten) in both the written test and the written work with oral presentation, will be dismissed from final exam.

Language of instruction:	Portuguese / English

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Departament of Marine Engineering

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Bachelor of Engineering in Marine Electrotechnical Engineering

Description of individual course unit

Course title:	**Health Care**		
Field:	Technical Management		
Course code:	923036	**Type of course:**	Mandatory
From:	September 2018		
Year of study:	3º	**Semester:**	2º
ECTS:	3	**Hours/week:**	30 h TP
Name of lecturer:	Teresa Cardoso Pinto		
Prerequisites:			

Objective of the course (expected learning outcomes and competences to be acquired):

Provide officials with theoretical and practical knowledge, so they can be able to deal with basic emergencies on board, within the strict scope of its competence, making them more apt to safeguard human life and to implement appropriate health levels, according with IMO-STCW Convention - Table A-VI / 4-1 and amendments.

Course contents:

1.Telemedicine and Consultation-Medical Network (3 Hours)
2.Network Survival (1 Hour)
3.Anatomia and Human Physiology (1 Hour)
4. Resuscitation Cardio-Respiratory (7 Hours)
5.Exame Victim (3 Hours)
6.Traumatology (6 Hours)
7. Injuries Caused by the Cold and Heat (2 Hours)
8. Accident Submergence (1 Hour)
9.Toxicology (1 Hour)
10. Medical Emergencies (3 Hours)
11. Theoretical Evaluation (2 Hours)
12. Cardiopulmonary Resuscitation
13. Vital Parameters Evaluation
14. Traumatology

This course contents comply the Model Course 7.08 – ETO, 2014 Edition Competences:
Item 3.4 APPLY MEDICAL FIRST AID ON BOARD SHIP
IMO Model Course No 1.14 and STCW 2010 Regulation VI/4, Table A-VI/4-1 for Proficiency in Medical First Aid

Recommended reading:

International medical guide for ships
World Health Organization (WHO)
Transport Ambulance Crew Manual
Basic Life Support Manual of the Portuguese Resuscitation Council

Teaching methods:

In order to enable students to evaluate and stabilize victims of sudden illness or accident, they were presented and practiced in the dummy basic life support techniques Life according to the current state of the art, according to the algorithm of the European Resuscitation Council. Also fixed fractures in simulated victim were practiced and the technique of lifting, as well as training on Vital parameters Evaluation.
In order to Provide Mercantile Marine Officers of theoretical and practical knowledge to implement and oversee health care on board in the strict framework of its powers, namely, based on the provisions of IMO-STCW convention, making them more able to safeguard human life and to implement appropriate health levels.
The work required in this course is developed, articulately, on two levels: theoretical and practical teaching. For

each of the chapters presented in lectures, designed to PowerPoint presentations that were compiled and distributed individually to each student at the beginning of the semester. Furthermore it is designed assignment sheets and practical assessment tasks sheets regarding the Cardiopulmonary Resuscitation and assignment sheets and working group task Sheets aimed at evaluating Vital parameters. Prior preparation of the work by the students and critical problem solving involves the field of theoretical knowledge. Thus, encourages the individual and group work inside and outside the classroom context.
Assessment methods:
Continuous assessment: -Two written test, with minimum classification – 9,5/20 -All practical skills Final exam: Written test -Practical exam – Basic Life Support

Language of instruction:	Portuguese / English

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