Course guide
280721 - 280721 - Avanced on Board Electronic Systems

Last modified: 09/05/2023

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: MASTER'S DEGREE IN THE MANAGEMENT AND OPERATION OF MARINE ENERGY FACILITIES (Syllabus 2016). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JOSEP MARIA TORRENTS DOLZ

Others: Segon quadrimestre:
JOSEP MARIA TORRENTS DOLZ - MGOIE

PRIOR SKILLS

A few electronic concepts

REQUIREMENTS

Having knowledge of the subject Naval Electronics (code 280647)

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE6-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis dels sistemes de generació, transport i distribució d'energia
CE7-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis de control avançat de processos d'operació, manteniment i reparació
CE9-MGOIEM. Coneixement i capacitat per projectar operacions de manteniment de sistemes de cogeneració marins, així com els seus sistemes de generació, transport i distribució d'energia elèctrica

Generical:
CG1-MGOIEM. Conocimientos suficientes en materias básicas y tecnológicas, que le capaciten para el desarrollo de nuevos métodos y procedimientos
CG2-MGOIEM. (ENG) Capacidad para resolver problemas complejos y tomar decisiones con responsabilidad sobre bases científicas y tecnológicas en el ámbito de su especialidad
CG3-MGOIEM. (ENG) Capacidad para concebir y desarrollar soluciones técnicas, económicas y medioambientales adecuadas a las necesidades de las instalaciones energéticas, de propulsión y auxiliares marinas
CG4-MGOIEM. (ENG) Capacidad para gestionar, optimizar y controlar los procesos de operación, reparación, rediseño, conversión, mantenimiento e inspección de las instalaciones anteriores
CG5-MGOIEM. (ENG) Capacidad de integración de sistemas marítimos complejos y de traducción en soluciones viables
CG6-MGOIEM. (ENG) Capacidad para desarrollar los conocimientos para el análisis e interpretación de mediciones, cálculos, valoraciones, tasaciones, peritaciones, estudios, informes y documentos técnicos en el ámbito de su especialidad
CG9-MGOIEM. Capacitat per a la gestió de l'explotació i operació de vaixells i artefactes marítims, la seva seguretat, prevenció de la contaminació i riscos laborals, salvament i rescats, suport logístic i manteniment
CG10MGOIEM. Capacitat per re-disseny i modificació d'equips i instal·lacions energètiques i de seguretat marines, dins l'àmbit de la seva especialitat, és a dir, operació, manteniment i explotació

Transversal:
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

Basic:
CB6. Possess knowledge and understanding that provide a basis or opportunity be original in the development and / or application of ideas, often in a research context.
CB8. Students should be able to integrate knowledge and handle the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the responsibilities social and ethical linked to the application of their knowledge and judgments.

TEACHING METHODOLOGY

The course is divided into seven topics: 1. Introduction to ship electronics; 2. Safety on the ship; 3. Power supply networks, corrosion and protection; 4. Batteries and charging systems; 5.Electric power converters to power equipment on the ship; 6. Sensors on the ship; and 7. Interference, noise and harmonics in the instrumentation of the ship. The topics include twenty-nine activities to be delivered through Athena during the semester. It is recommended to submit the activities evenly throughout the semester; also to facilitate teacher feedback. Four classroom practices are also being developed in the FNB's electronics lab.

LEARNING OBJECTIVES OF THE SUBJECT

Electronics have become widespread in almost all ship systems. Thus, these systems must coexist in a compatible way and without interfering (electromagnetically) with which content has been reinforced and added to ensure that performance and safety aspects at sea.

Use of electronic instrumentation for equipment surveillance.
Operation and measurement differences between analog and digital electronics and boat power.
Electronic security control devices.
Power supply networks, corrosion and boat protections.
Location and repair of electronic equipment faults.
Batteries and charging systems.
Electric power converters to power equipment on the ship (dc/ac and dc/dc).
Sensors on the boat.
Interference, noise and harmonics in the instrumentation of the ship.

This course will evaluate the following STCW competences:
Manage operation of electrical and electronic control equipment
Manage troubleshooting, restoration of electrical and electronic control equipment to operating condition

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	100.00

Total learning time: 45 h

CONTENTS

Index of contents of the subject with example of timing

Description:
Topic 1: Introduction to ship electronics. (2 weeks). Assignment 1 and 2.
Topic 2: Electrical safety on the boat. (2 weeks). Assignment 3 to 6.
Topic 3: Power supply networks, corrosion and protection of the ship. (2 weeks). Assignment 7 to 11.
Topic 4: Batteries and their charge. (3 weeks). Assignment 12 to 17.
Topic 5: dc / ac and dc / dc converters. (2 weeks). Assignment 18 to 22.
Topic 6: Sensors. (3 weeks). Assignment 23 to 28.
Topic 7: Interferences. (1 week). Assignment 29.

Practice 1: Measurement of harmonic distortion.
Practice 2: Temperature measurement with a Pt100.
Practice 3: Measurement of flow and volume.
Practice 4 (and last): Ultrasonic distance measurement.

Full-or-part-time: 48h
Guided activities: 8h
Self study : 40h

Web based literature

Description:
Specific book close to the subject of Professor Lluís Closas. OpenCourseWare:
https://ocw.upc.edu/curs_publicat/280721/2017/1/apunts

Example of a basic electronics book: "Principios de Electrónica" by Albert Paul Malvino in some UPC libraries and at:
https://discovery.upc.edu/iii/encore/record/C__Rb1510233? lang = cat

Complementary book (book for Naval Electronics by Professor Lluís Closas). OpenCourseWare:
https://ocw.upc.edu/curs_publicat/280647/2017/1/apunts

Operational Amplifiers (AO, OpAmp or OA), websites consulted January 14, 2021. Note of basic application, ideal AO's. Suitable for Naval Electronics:
http://www.ti.com/lit/an/slaa068b/slaa068b.pdf

Very complete application note on AO's (includes single supply, pcb's considerations, filter design, oscillators ...). Written by Ron Mancini (editor), Bruce Carter, et al. Suitable for analog design:
https://www.cypress.com/file/65366/download

Example of Wheatstone Bridge conditioning (pressure sensor) with AO's (Pressure Transducer to ADC Application):
https://www.datasheetarchive.com/pdf/download.php? id = 4e543e690f6fcf994c6322c6ab940027e50960 & type = P & term = SLAA068

Full-or-part-time: 20h
Self study : 20h

GRADING SYSTEM

The final grade is calculated from three parameters with weights: 35% activities + 30% laboratory + 35% final exam.

BIBLIOGRAPHY

Basic:
- Pallàs Areny, Ramon; Webster, John G. Sensors and Signal Conditioning [on line]. 2nd ed. New York [etc.]: John Wiley & Sons, cop. 2001 [Consultation: 01/09/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4747125. ISBN 9781118585931.
- Pallás Areny, Ramón. Adquisición y distribución de señales. Barcelona: Marcombo, 1993. ISBN 8426709184.
- Calder, Nigel. Boatowner's mechanical and electrical manual : how to maintain, repair, and improve your boat's essential systems. 3rd ed. Londres: Adlard Coles Nautical, 2005. ISBN 9780713672268.
- Closas Torrente, Lluís; Closas Gómez, Pau. Electrònica Naval. 2a ed. [Tarragona]: Nautical Union, 2013. ISBN 9788494107023.

Complementary:
- López Rodríguez, Victoriano. Teoría de circuitos y electrónica [on line]. Madrid: Universidad Nacional de Educación a Distancia, [2013] [Consultation: 01/09/2022]. Available on: https://lectura-unebook-es.recursos.biblioteca.upc.edu/viewer/9788436265316. ISBN 9788436265316.
- González de la Rosa, Juan José; Moreno Muñoz, Antonio. Circuitos electrónicos aplicados con amplificadores operacionales : teoría y problemas [on line]. Cádiz: Servicio de Publicaciones de la Universidad de Cádiz, 2009 [Consultation: 30/05/2022]. Available on: https://lectura-unebook-es.recursos.biblioteca.upc.edu/viewer/9788498284249. ISBN 9788498284249.

RESOURCES

Other resources:
Laboratory of Electronics