

Course guide

280687 - 280687 - Maintenance and Repair of Radionavigation Equipment and Radio Communication Systems

Last modified: 28/06/2024

Unit in charge:	Barcelona School of Nautical Studies		
Teaching unit:	707 - ESAII - Department of Automatic Control.		
Degree:	BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Optional subject).		
Academic year:	2024	ECTS Credits:	6.0
		Languages:	Spanish, English

LECTURER

Coordinating lecturer:	EZEQUIEL BERNAL GARCIA
Others:	Segon quadrimestre: EZEQUIEL BERNAL GARCIA - GTDT

PRIOR SKILLS

Knowledge of local area networks and their elements such as Router, Gateway, Bridge, NAS, etc... as well as wiring categories and types. Knowledge of the assembly of a PC and its elements and installation of operating systems.

REQUIREMENTS

It is necessary to have passed the subject 280647 Naval Electronics to be able to take this subject

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

STCW:

1. A-III/6-1. Function: Electrical, electronic and control engineering at the operational level
2. A-III/6-1.7 Use internal communication systems
3. A-III/6-KUP 1.7.1 Operation of all internal communication systems on board
4. A-III/6- 2. Function: Maintenance and repair at the operational level
5. A-III/6-2.3 Maintenance and repair of bridge navigation equipment and ship communication systems
6. A-III/6-CCS 2.3.1 Knowledge of the principles and maintenance procedures of navigation equipment, internal and external communication systems
7. A-III/6-CCS 2.3.2 Theoretical knowledge: Electrical and electronic systems operating in flammable areas
8. A-III/6-CCS 2.3.3 Practical knowledge: Carrying out safe maintenance and repair procedures
9. A-III/6-CCS 2.3.4 Practical knowledge: Detection of machinery malfunction, location of faults and action to prevent damage

TEACHING METHODOLOGY

There will be master classes, where presentation tools will be used and real facilities plans will be exposed.
Practical classes will be held using the available radiocommunications and navigation aid equipment and the Simulators of the Bridge and Engine Room, where a battery of failures will be executed so that the students, working as a team, analyze and reason the situations raised, and apply and justify the more favorable solutions.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student will be able to:

- Interconnect navigation and communications equipment using the most appropriate electrical protocols and standards (NMEA0183, CAN BUS, ethernet, etc...).
- Evaluate the failures of a RADAR system
- Evaluate the failures of an ECDIS system
- Evaluate the failures of a Government System including, GYROSCOPIC AND MAGNETIC COMPASS, AUTOPILOT
- Evaluate the failures of different types of EcoProbes and Slides
- Recognize the different VDRs.
- Identify the most common failures of all onboard radio communications equipment and understand the elements of a radio inspection.
- Perform installation of ship's navigation and communications equipment in accordance with manufacturer's safety guidelines and onboard instructions, legislative and safety specifications.
- Know how to make a service report to communicate it to a technical service approved by the manufacturer.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	60,0	40.00

Total learning time: 150 h

CONTENTS

Unit 1. Introducció als Sistemes de Radionavegació i Comunicacions

Description:

Introduction to ETO

IMO, Certifications, Classes and Flags

Preventive and Corrective Maintenance

Onboard instrumentation: radio communications equipment, electronic navigation equipment

Integrated Navigation Bridge

Battery Principles

Satellite communications

List of types of boats and mandatory equipment

Equipment for detection, location and repair of faults: Essential tools for an ETO

Full-or-part-time: 5h

Theory classes: 1h

Practical classes: 1h

Laboratory classes: 1h

Guided activities: 1h

Self study : 1h

Unit 2. Transmission lines

Description:

Functions of the three main parts of an electronic communication system.
 Different types of electronic communication devices and examples of each type.
 Modulation and multiplexing to facilitate signal transmission.
 Electromagnetic spectrum and nature
 Regulation of electromagnetic waves. Spectrum.
 Frequency range and bandwidth.
 Maritime electronic communications.
 Types of transmission lines, applications of each one.
 Characteristic impedance and calculation of the characteristic impedance of a transmission line by using various methods.
 Calculation of the length of a transmission line in wavelengths.
 Standing wave ratio (SWR), importance for transmission line design and calculation of SWR using impedance values or reflection coefficient.
 Characteristics of a radio wave.
 Calculation of the length of quarter-wavelength and half-wavelength antennas, given the operating frequency.
 Basic types of antennas and the characteristics of each one.

Full-or-part-time: 6h

Theory classes: 2h
 Practical classes: 1h
 Laboratory classes: 1h
 Guided activities: 1h
 Self study : 1h

Unit 3. Global Maritime Distress and Safety System

Description:

History of Communications
 Regulations
 VHF Radios
 MF/HF Radios
 Portable VHF
 SART
 INMARSAT C
 INMARSAT FBB
 IRIDIUM
 EPIRB
 Ship Safety Alert Systems (SSAS)
 Long Range Vessel Identification and Tracking (LRIT) System
 Batteries and battery charger
 Main manufacturers
 Radio Inspection: elements to take into account
 Preventive Maintenance
 Common tests and failures

Full-or-part-time: 75h

Theory classes: 5h
 Practical classes: 10h
 Self study : 60h

Unit 4. Other communications equipment: Connectivity

Description:

Very Small Aperture Terminals (VSAT)
Alternative satellite systems: Starlink
WLAN networks, Wimax
Other Iridium Services
Other INMARSAT services
Preventive Maintenance
Common tests and failures

Full-or-part-time: 120h

Theory classes: 10h
Practical classes: 50h
Self study : 60h

Unit 5. Bridge navigation equipment

Description:

Bridge equipment description
Positioning: GPS, GLONASS, GALILEO, BeiDou
Automatic Radar Plotting Aid (ARPA)
Compass Types and Government Systems
Sliding
Autopilots
Echo sounders
Anemometers
Electronic Chart Systems (ECDIS)
Trip Data Recording (VDR)
CCTV cameras
Preventive Maintenance
Common tests and failures

Full-or-part-time: 75h

Theory classes: 10h
Practical classes: 5h
Self study : 60h

GRADING SYSTEM

The final grade (N_{final}) is the weighted sum of the following partial qualifications:

$$N_{final} = 0.4 N_{pf} + 0.6 N_{ac\&L}$$

where N_{pf} is the mark of the final test and $N_{ac\&L}$ is the mark of the activities of continuous evaluation (exercises, works) and the mandatory laboratory practices and simulator training with the bridge and engine room simulators

EXAMINATION RULES.

- Students who do not take part in any of the continuous assessment activities will be considered as Not Presented (NP)
- Students who do not take the final test, even though they have fulfilled part or all of the other activities, will be considered Not Presented (NP)
- During the tests, only pens, pencils and calculator are allowed

BIBLIOGRAPHY

Complementary:

- Electro-technical officer. IMO model course 7.08. London: International Maritime Organization, 2014. ISBN 9789280115802.
- Colin, Jones. Marine electronics handbook : choice, installation and use. Shrewsbury: Waterline Books, 1997. ISBN 1853108820.
- Carr, Joseph J.; Hippisley, George W. Practical antenna handbook [on line]. 5th ed. New York: McGraw-Hill, 2012 [Consultation: 03/07/2024]. Available on : <https://www-accessengineeringlibrary-com.recursos.biblioteca.upc.edu/content/book/9780071639583?implicit-login=true>. ISBN 9780071639583.
- Figueras Blanch, Manuel. Comunicaciones náuticas : instalación y uso de los equipos VHF, BLU, Satélites y GMDSS. Madrid: Tutor, 2003. ISBN 8479023945.
- Popovic, Z.; Popovic, B. D. Introductory electromagnetics. Englewood Cliffs: Prentice-Hall, 2000. ISBN 9780201326789.
- Lynn, Paul A. Radar systems. Houndmills: Macmillan Education, 1987. ISBN 033342543X.
- Harris, Mike. Communications at sea. Dobbs Ferry: Sheridan House, 2003. ISBN 1574091611.
- Meana Díaz, Elías. Manual práctico del sistema mundial de socorro y seguridad marítima SMSSM. Barcelona: Noray, 2006. ISBN 8474861667.
- Navy Electricity and Electronics Training Series (NEETS), vol. 10 Propagation, transmission lines, and antennas [on line]. [lloc de publicació desconegut]: Center for Surface Combat Systems, 2019 [Consultation: 19/07/2021]. Available on : <https://www.hnsa.org/manuals-documents/2575-2/>.
- Carr, Joseph. Microwave and wireless communications technology [on line]. Boston: Butterworth-Heinemann, 1997 [Consultation: 25/09/2024]. Available on : <https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780750697071/microwave-and-wireless-communications-technology>. ISBN 9786611077624.
- Rudge, A. W (ed). The Handbook of antenna design. Vol 2 Coaxial transmission lines and components,. 2nd ed. London: Peter Peregrinus, 1986. ISBN 0863410529.
- Frenzel, Louis E. Principles of electronic communication systems. 5th ed. New York: McGraw-Hill, 2023. ISBN 9781260597899.
- Tetley L.; Calcutt, D. Electronic navigation systems [on line]. 3rd ed. [s.l.]: Newly published, 2007 [Consultation: 23/09/2024]. Available on : <https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.4324/9780080477510/electronic-navigation-systems-david-calcutt-laurie-tetley>. ISBN 9781136407253.
- Anand, M.L. Modern electronics and communication engineering [on line]. Boca Raton: CRC Press, 2021 [Consultation: 23/09/2024]. Available on : <https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.1201/9781003222972/modern-electronics-communication-engineering-anand>. ISBN 9781003222972.
- GMDSS manual : global maritime distress and safety system. 11th edition. London: International Maritime Organization, 2024. ISBN 9789280117707.

RESOURCES

Other resources:

Bridge Simulator TRANSAS NTPro 5000
Engine Room Simulator TRANSAS ERS 5000
Radio Simulator TRANSAS SMSSM TFG 5000
ETO Laboratory