

Course guide

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

Last modified: 09/05/2023

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: 2023 **ECTS Credits:** 6.0 **Languages:** Spanish, English

LECTURER

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

PRIOR SKILLS

Knowledge about local area networks and communications

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 radio communications 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:

- Accurately identify the effect of malfunctions on bridge navigation equipment and ship communication systems
- Correctly interpret ship's technical drawings
- Correctly use measuring and calibrating instruments
- Justify the taken actions
- Perform the isolation, dismantling and reassembly of bridge navigation equipment and ship communication systems in accordance with manufacturer's safety guidelines and shipboard instructions, legislative and safety specifications.
- Take actions that lead to the restoration of bridge navigation equipment and ship communication systems by the method most suitable and appropriate to the prevailing circumstances and conditions
- Carry out the repair if possible on board, with or without remote assistance, and if the repair "on site" is not possible, make the appropriate report for specific technical assistance from a technician approved by the manufacturer of the equipment involved

STUDY LOAD

Type	Hours	Percentage
Guided activities	5,0	3.33
Self study	90,0	60.00
Hours medium group	15,0	10.00
Hours large group	30,0	20.00
Hours small group	10,0	6.67

Total learning time: 150 h

CONTENTS

Unit 1. Introduction to maritime radio communication systems

Description:

Basic concepts.

Onboard instrumentation: Radiocommunication equipment, radar units, integrated bridge systems

The radio spectrum. Frequency bands. Bandwidth.

Channels. Simple channels and duplex channels.

Types of propagation. Direct wave propagation, surface wave propagation and ionospheric propagation. Maritime communications frequency bands.

Main elements of a radio station.

Battery life.

Types of maintenance and equipment for the detection, location and repair of breakdowns

Full-or-part-time: 45h

Theory classes: 10h

Guided activities: 5h

Self study : 30h

Unit 2. Transmission lines

Description:

Current and voltage waves in a conductor.
Difference between a conductor and a transmission line.
Power of an electric wave.
Characteristics of a transmission line. Characteristic impedance.
Mantenimiento y reparación de líneas de transmisión
Propagation and reflection of electrical waves a transmission line.
Stationary wave ratio.
Adaptation of impedance.
Types of transmission lines.
Coaxial lines. Elements of a coaxial line.
Common problems of a coaxial line.
Attenuation.
Connection of a coaxial line.
Insertion losses.
Detection of reflections in a coaxial line.
Measurement of standing waves in a coaxial line.
Maintenance and repair of transmission lines

Full-or-part-time: 45h

Theory classes: 10h

Practical classes: 5h

Self study : 30h

Unit 3. Antennas

Description:

Electrical resonance in an antenna.
Radiation from an antenna.
Isotropic antenna.
Unidirectional and omnidirectional antennas.
Principle of reciprocity.
Efficiency and gain of an antenna.
Bandwidth.
Input impedance.
Isolation and tuning of an antenna.
Main types of antennas used in maritime communications.
Antennas of $\lambda / 2$.
Antennas of $\lambda / 4$.
Installation of an antenna.
Antenna maintenance.

Full-or-part-time: 50h

Theory classes: 10h

Practical classes: 5h

Laboratory classes: 5h

Self study : 30h

Unit 4. Maintenance and failure detection in radiocommunication equipment

Description:

Preventive maintenance and fault detection
Corrective actions on board or with assistance from the Manufacturer's Technical Service
Ship Safety Alert Systems (SSAS)
Long Range Vessel Identification and Tracking System (LRIT)
Automatic Identification System (AIS)
Other equipment: Satellite communications

Full-or-part-time: 5h

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

Unit 5. Maintenance and detection of failures in the bridge navigation equipment

Description:

Predictive maintenance and fault detection
Corrective actions on board or with the assistance of the Technical Service of the Manufacturer of the bridge navigation equipment
RADAR
Automatic Radar Plot Assist (ARPA)
Satellite navigation systems
Time signature
Sliding
Autopilots
Echo sounders
Electronic chart systems (ECDIS)
Voyage data recording (VDR)
Anemometers
Navigation lights
Horns and search lights

Full-or-part-time: 5h

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

GRADING SYSTEM

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

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

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:

- Rudge, A. W (ed). The Handbook of antenna design. Vol 2 Coaxial transmission lines and components,. London: Peter Peregrinus, 1986. ISBN 0863410529.
- Colin, Jones. Marine electronics handbook. Shrewsbury: Waterline Books, 1997. ISBN 1853108820.
- Figueras Blanch, Manuel. Comunicaciones náuticas. Madrid: Tutor, 2003. ISBN 8479023945.
- Harris, Mike. Communications at sea. Dobbs Ferry: Sheridan House, 2003. ISBN 1574091611.
- Lynn, Paul A. Radar systems. Houndmills: Macmillan Education, 1987. ISBN 033342543X.
- Carr, Joseph J.; Hippisley, George W. Practical antenna handbook. 5th ed. New York: McGraw Hill, 2012. ISBN 9780071639583.
- Meana, Elías. Manual práctico del sistema mundial de socorro y seguridad marítima SMSSM. Barcelona: Noray, 2006. ISBN 8474861667.
- Carr, Joseph. Microwave and wireless communications technology. Oxford: Newnes, 1996. ISBN 9780080511665.
- Popovic, Z.; Popovic, B. D. Introductory electromagnetics. Englewood Cliffs: Prentice-Hall, 2000. ISBN 9780201326789.
- 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/>.
- Electro-technical officer. IMO model course 7.08. London: International Maritime Organization, 2014. ISBN 9789280115802.

RESOURCES

Other resources:

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