**Marine Technology Instrumentation:**

**Name of the subject (English):** Marine Technology Instrumentation  

**Coordinating unit:** ETSETB - Escola Tècnica Superior d'Enginyeria de Telecomunicació de Barcelona  

**Teaching unit:** Electronical Engineering Department  

**Study programme:**  
- Master in Telecommunications Engineering  
- Master in Electronic Engineering  

**ECTS credits:** 5  

**Type of subject (compulsory, elective, seminar):** Elective  

**Type of learning (face-to-face, semi-distance learning, distance learning):** Face-to-face  

**Weekly hours of theory and laboratory (3T+0L, 2T+1L, 1T+2L, 0T+3L):** 20T+15L (3 intensive weeks)  

**Pre-requisites:** None.  

**Co-requisites:** None.  

**Coordinator:** Joaquin del Rio Fernandez  

**Other teaching staff (minimum 2):** Daniel Mihai Toma, Spartacus Gomariz  

**Capacity of the course:** 3  

**Any specific classroom?:** AA204 (Vilanova i la Geltrú Campus)  

**Any specific laboratory?:** AL106 (Vilanova i la Geltrú Campus)  

**Capacity of the laboratory:** 3  

**Master competences to which the subject contributes:**  

**Specific competences:**  
- **CE1:** Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.  
- **CE2:** Ability to develop radio-communication systems: antennas design, equipment and subsystems, channel modeling, link dimensioning and planning.  
- **CE3:** Ability to implement wired and wireless systems, in both fix and mobile communication environments.  
- **CE4:** Ability to design and dimension transport, broadcast and distribution networks for multimedia signals.  
- **CE8:** Ability to understand and to know how to apply the functioning and organization of the Internet, new generation Internet technologies and protocols, component models, middleware and services.
– CE14: Ability to develop electronic instrumentation, as well as transducers, actuators and sensors.

Transversal competences:
– CT3: Teamwork. To be able to work as a member of an interdisciplinary team either as a member, or performing management tasks in order to help develop projects with pragmatism and sense of responsibility, assuming commitments given available resources.
– CT4: Solvent use of information resources. Managing the acquisition, structure, analysis and visualization of data and information in the field of the speciality and critically evaluate the results of this effort.
– CT5: Third language. Learning a third language which shall preferably be English, with an appropriate level of oral and written form and in line with the future needs of the graduates.

Teaching methodology:
– Lectures
– Laboratory classes
– Laboratory practical work
– Oral presentations
– 3Extended answer test (Final Exam)

Learning objectives and results of the subject:

Learning objectives of the subject:
The aim of this course is to train students in methods of design, dimensioning and evaluation of data communications networks. First, we consider the parameters of interest for telematics network planning and mathematical tools we have. Then, using this knowledge, will study data routing mechanisms, network allocation capacity, congestion control and multiple access techniques.

Learning results of the subject:
– Ability to specify, design networks, services, processes and applications of telecommunications in both a fixed, mobile, personal, local or long distance, with different bandwidths in multicast networks, including voice and data.
– Ability to apply both traffic engineering tools as planning tools, dimensioning and network analysis.
- Ability to analyse, model and implement new architectures, network protocols and communication interfaces and new network services and applications.
- Ability to analyse, model and apply advanced techniques both security, including cryptographic protocols, firewalls, and collection mechanisms, authentication and content protection.

**Study load:**
Total learning time: 125h

**Content:**

1. Image processing for submarine video images.
2. Electric Power Quality and Ship Accidents
3. Smartphone and augmented reality for on-site and remote applications in the field of measurements
4. Introduction to signal preprocessing circuits for sensors and description of digitizing circuits (parameters, errors, error correction methods, ADC architectures and models, ADC testing
5. Measure of water quality (conductivity, turbidity, pH, etc.) and IEEE 1451 family of standards in marine instrumentation
6. Wireless Sensor Networks (WSN): introduction and applications. Distributed measurement systems for water quality monitoring; WSN with underwater links. GPS and its use in surface and underwater navigation
7. Tracking and labeling of species. Hydrophones, ceramic piezoelectrics, audio amplifiers Digital communication applied to underwater acoustics
9. Practice on navigation, related sensors and measuring systems
10. Introduction to Wireless Sensor Network. DAC basics. Overview of instrumentation and measurement chain. Introduction to oceanographic measurement systems: properties, applications and technology challenges
11. Inertial, classical and electronic compass navigations, LORAN, GPS, magnetic sensors and underwater magnetic observatories and communication basics - from modulations to GNSS.
12. Analog functions for measurement signals

16. Introduction to signal preprocessing circuits for various sensors and if needed also description of digitizing circuits (parameters, errors, error correction methods, ADC architectures and models, ADC testing

**Planning of activities:**

**Laboratory:**

- P1. Matlab with the toolbox "image processing"
- P2 Image processing in OBSEA observatory
- P3 Use of LabView as a tool in the design of the measurement systems applied to the marine environment, exercises using real time FPGA system myRIO
- P4: Acquisition and signal processing using Matlab
- P5. Use of Matlab for underwater acoustics simulations
- P6. Coastal ocean observatories and Radio link
- P7. Equipment for measuring the water column. Measurement of conductivity and depth. Calibration of CTDs
- P8. Navigation test with Guanay II. Motion simulation with Matlab-Simulink
- P9. "Plug & work" and time synchronization of instruments
- P10. Numerical simulations of rigid body motion and a simple multi-body system using Matlab-Simulink

**Oral presentation:**

- Description: Presentation of a work group.

**Qualification system:**

Group assessments: 100%

**Bibliography:**


- Scientific papers from Journal of Oceanic Engineering Society http://www.oceanicengineering.org