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COURSE CATALOGUE

List of Master's level courses taught in English

Available in 2020-21
Business & Management

From Fall 2021 :
Computer Science and IoT
Electrical Engineering
Marine Technologies

BREST CAMPUS: 2020- 2021: Master's Level *(intended and currently available classes)*

ELECTIVE : Business & Management *(available from Fall 2020)*	**Codes**	**ECTS**
Corporate Social Responsibility	MANPM-512EN	3
Competitive Strategy	MANCS-512EN	3
Project Management	MANSR-522EN	3
Marketing of Innovation	HFRMI-523EN	3
Marketing B to B	HFRMB-523EN	3
Advanced Information Systems Management	HFRMS-523EN	3
Contract law in IT	HFRCL-523EN	3
ELECTIVE: Computer Science and IoT *(available from Fall 2021)*	**Course code**	**ECTS**
Advanced electronics for telecommunication	IOTET-512EN	3
Laboratory in IoT-based LoRa deployment	IOTLO-512EN	3
Image processing	IOTIP-512EN	3
Deep learning	IOTDL-512EN	3
Mobile development	IOTMD-512EN	3
Java web development	IOTJW-512EN	3
Java framework	IOTJF-522EN	3
Laboratory project	IOTLP-514EN	9
ELECTIVE: Electrical Engineering *(available from Fall 2021)*	**Codes**	**ECTS**
Electrical machines and drives	ELEEM-522EN	3
Renewable energy technologies	ELERT-512EN	3
Electric propulsion	ELEEP-512EN	3
1 module from the Computer sciences and IoT track	IOT__-___EN	3
Laboratory project	ELELP-514EN	9
ELECTIVE: Marine Technologies *(available from Fall 2021)*	**Codes**	**ECTS**
Oceanography	MRTOC-512EN	2
Marine Observatories	MRTMO-512EN	3
Underwater Instrumentation and Communication	MRTUI-512EN	3
Renewable Energy Technologies	ELERT-512EN	3
Laboratory project	MRTLP-514EN	9

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BREST CAMPUS

MASTER 2

Business & Management

(Ingénieur Projets d'Affaires)

Fall Semester 2020

Spring Semester 2021

Corporate Social Responsibility				
Year: 2020-21		**Programme:** BUSINESS & MANAGEMENT		
Class code: HFRSR-522EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Anne CHOQUET				

Pre-requisites:
Students are expected to have an understanding of knowledge of corporate policy and strategy, and of management
Learning outcomes:

At the end of the course, the student should be able to:
Apply high standards of ethics and professional responsibility to positively contribute to business and society

In line with the program objective, the purpose of this module is to enable students to develop critical awareness of corporate social responsibility issues in management and learn about appropriate management responses.
This module supports the learning outcomes related to students being able to:

- Integrate sustainability practices into company management and policies, thus creating sustainable value.
- Manage organizational change and innovation, as building CSR into the company's management often requires significant change. This module enables students to find responsible solutions to business problems by finding innovative solutions taking into consideration international and interdisciplinary differences.

Course description:

This course prepares students to analyze and evaluate critical issues regarding the social, ethical and environmental responsibilities of business, to transfer sustainability-related knowledge and ethical theories to business practice, and to assess the relevance of CSR tools and apply them to specific business needs.

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Practical activities	12
Independent study	
Estimated personal workload	93
Total student workload	**120 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Group	Work in class	40%
Other assignments		
Final written report	1	60%
Project evaluation		
Total		**100%**

Recommended reading:
- Crane, Andrew & Matten, Dirk. (latest edition). Business Ethics. Oxford University Press.
- Weiss, Joseph W. (latest edition). Business Ethics: A Stakeholder and Issues Management Approach. Berrett-Koehler Publishers. [eBook available]

Additional Reading

- Bird, F.B. Waters, J.A. Managers' Moral Muteness. California Management Review (1989), Vol. XXXI, 73-88.
- Boatright, John R. (2014). Ethics in Finance. (3rd edn). John Wiley & Sons. Blackwell. [eBook available]
- Boatright, John R. (2014). Ethics and the Conduct of Business. (7th edn). Pearson Education.
- Bowie, Norman E. & Werhane, Patricia H. (2005). Management Ethics. Malden & Oxford, Blackwell.
- Carroll, Archie B. & Buchholtz, Ann K. (2011). Business & Society. (8th edn). Manson, Thomson.
- Crane, Andrew, Matten, Dirk & Moon, Jeremy. (2008) Corporations and Citizenship. Cambridge, Cambridge University Press. [eBook available]
- Rossouw, Deon & Stückelberger, Chrisoph. (2012). Global Survey of Business Ethics in Training, Teaching and Research. Basel:Globethics.net. Download available at: http://www.globethics.net/web/ge/library/libraries-home
- Sethi, Prakash S (2003). Setting Global Standards. Hoboken: John Wiley & Sons. [eBook available]
- Stiglitz, Joseph E.(2007). Making Globalization Work. New York: W. W. Norton & Company.
- Valasquez, Manuel G. (2011). Business Ethics: Concepts and Cases. (7th edn). Upper Saddle River: Prentice Hall.

Internet Resources:
www.csr-news.net - www.ethicalcorp.com - www.novethic.fr (a comprehensive site, but in French only), www.unglobalcompact.org (with a large data bank on corporate CSR activities). You will find more links on these websites

Note: This information is non-binding and can be subject to change

Competitive Strategy				
Year: 2020-21	**Programme:** BUSINESS & MANAGEMENT			
Class code: HFRCS-512EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS**: 3
Lecturer: Dr. Suela BYLYKBASHI				

Pre-requisites: None

Learning outcomes:

At the end of the course, the student should be able to:
1. Conduct a strategic management diagnosis to identify a competitive advantage.
2. Formulate decisions and strategic choices.
3. Elaborate the process of implementing the strategic choices.

Course description:

The focus of this module is on Strategic Analysis on competitive and dynamic markets. This module deals mainly with two goals: (1) To increase the students' understanding of what managers must do to make a business sustainable and performant in the long term; and (2) to develop the student's ability to lead a Strategic Analysis of a firm on highly competitive and dynamic markets.

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Practical activities	12
Independent study	
Estimated personal workload	93
Total student workload	**120 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Group	Work in class	40%
Other assignments		
Final written report	1	60%
Project evaluation		
Total		**100%**

Recommended reading:

- Barney, J.B. (2013). Gaining and Sustaining Competitive Advantage. (4th edn). Boston: Pearson (eBook available).
- Choudary, Sangeet P., Van Alstyne, Marshall W., Parker, Geoffrey G. (2016). Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You. WW Norton & Co / Chapter 10 .Link will be provided on Moodle.
- Fleisher, C. S., & Bensoussan, B. E. (2015). Business and competitive analysis: effective application of new and classic methods. FT Press.
- Oster, S. M. (1994). Modern competitive analysis. (2nd edn). OUP Catalogue.

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Articles on Strategy & Competitive Advantage

- Porter, M. E. 1996. What is a strategy? Harvard Business Review (November-December): 61-78.
- Collins, J. C., & Porras, J. I. (1996). Building your company's vision. Harvard Business Review, 74(5), 65.
- Porter M, E. (2008). The five competitive forces that shape strategy. Harvard Business Review, 86(1), 2-17. - Courtney, H., Kirkland, J., & Viguerie, P. (1997).Strategy under uncertainty. Harvard Business Review, 75(6), 6779.

Internet Resources:

Competitive strategy in the age of platforms

- Eisenmann, Parker & Van Alstyne, 2011. “Platform Envelopment.” *Strategic Management Journal*, 32, no. 12 (December): 1270–1285. Link: https://papers.ssrn.com /sol3/papers.cfm?abstract_id=1496336
- Choudary, S. 2014. “Building the Next WhatsApp or Instagram: The Network Effect Playbook.” *Wired*, March.Link: https://www.wired.com/insights/2014/03/building-next-whatsapp-instagram-network-effect-playbook/
- "What Killed Michael Porter's Monitor Group" by Steve Denning (2012) *Forbes*; Nov. 20. Link: https://www. forbes.com/sites/stevedenning/2012/11/20/what-killed-michael-porters-monitor-group-the-one-force-that-reallymatters/#22dd5a94747b

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Project Management				
Year: 2020-21		**Programme:** BUSINESS & MANAGEMENT		
Class code: HFRPM-512EN				
Level: Master	**Year: 2**	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Patrick HUBERT				

Pre-requisites:

Students should be familiar with the various departments of a company. They should have sufficient computer skills to use Microsoft Project or similar software.

Learning outcomes:

At the end of the course, the student should be able to:

- Explain and assess project requirements (and evaluate the associated techniques)
- Analyze project quality and project risks (and evaluate associated techniques)
- Explain the alternative options - traditional or agile - to plan, monitor and control a project
- Explain the purpose of performance management in projects (and evaluate the associated techniques)
- Apply generic project tools (and evaluate the associated techniques)
- Explain the nature of project information and communication (and evaluate the associated techniques)

Course description:

This module teaches students why projects matter in a changing business environment, their impact on organizations, how they are created, managed and implemented, how students will be involved as individuals, team members and managers, and how performance relates to projects. The goal is to teach the students how to effectively organize and run a structured project in various environments and positions. The topics range from the global transitions causing projects to key success factors and include major issues such as the project environment, project management methods, project team management and risk management.

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Practical activities	12
Independent study	
Estimated personal workload	93
Total student workload	**120 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Group	Work in class	30%
Other assignments		
Final written report	1	70%
Project evaluation		
Total		**100%**

Recommended reading:

. Kerzner, (Latest Edition) Project management: a system approach to planning, scheduling, and controlling. John Wiley & Sons.

Additional Reading

- Kendrick, T. (2012). Results without Authority. Amacom. [eBook available]
- Lock D. (2013) Project management. (10th edn), Gower. [eBook available]
- Meredith J. R., Mantel S. J. (2015) Project Management: a managerial approach. (9th edn). John Wiley & Sons.
- Nicholas J. M. (1990) Managing business & engineering projects, Prentice Hall
- Yourdon E. (2004) Death march, 2nd edition, Prentice Hall

Internet Resources:
www.pmi.org www.projectsmart.co.uk
www.agilealliance.org/

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Marketing of Innovation				
Year: 2020-21		**Programme:** BUSINESS & MANAGEMENT		
Class code: HFRMI-523EN				
Level: Master	**Year: 2**	**Period:** Spring	**Language of instruction:** English	**ECTS: 3**
Lecturer: Suela BYLYKBASHI				

Pre-requisites:
"MK301N - Fondamentaux du Marketing I" and "MK302E - Marketing Fundamentals II" or equivalent.

Learning outcomes:

At the end of the course, the student should be able to:

1. Plan a marketing campaign using innovative marketing platforms,
2. Explain the cycles of consumer adoption of innovations and the obstacles to accelerating the rate of adoption,
3. Identify the competitive advantages of successful innovative companies, and the key success factors of top-rated innovative products and services,
4. Evaluate the strengths and weaknesses of major business models in the marketplace,
5. Explore the potential of value in interaction co creation

Course description:

This module examines new technology, in particular, often leads to shortened product life cycles, demand for continual product updates, increases in the perceived risk of adoption by customers, increased requirements for intensive customer service and growing reliance on business partners (suppliers, vendors, and distributors). This module focuses, via relationship marketing on understanding these changes and developing successful marketing strategies and tactics for innovative products/services. It fosters a cohesive understanding of how marketing activity at all phases of the innovation process can maximize ultimate commercial success.

Course structure and workload:

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Practical activities	12
Independent study	
Estimated personal workload	93
Total student workload	120 hours

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Group	Work in class	40%
Other assignments		
Final written report	1	60%
Project evaluation		
Total		100%

Recommended reading:

. Mitra, J. (2017) The business of Innovation. Sage.
. Moore, G. (2004). Inside the tornado: Strategies for Developing, Leveraging, and Surviving Hypergrowth Markets, Harpercollins Publishers.
. Christensen, Clayton M. (2011). The innovator's dilemma: The Revolutionary Book That Will Change the Way You Do Business.(Reprint). New-York: Harperbusiness. [eBook available].
.Rogers, E. (2003). Diffusion of Innovations, Free Press.

Additional Reading

. Trott, Paul (2012). Innovation management and new product development. (5th edition). [S.l.]: Prentice Hall.
. Virden, T.W. (1995). Can This High-Tech Product Sell Itself?. Harvard Business Review, 73, 6, pp. 24-28.
. Gourville, J.T. (2006). Eager Sellers and Stony Buyers. Harvard Business Review, 84, 6, pp. 98-106.
. Crossing the Chasm – A summary by Andersen.
. A Summary of Crossing the Chasm – Linowes.
. Andrew, J. and Sirkin, H. (2003). Innovating for Cash, Harvard Business Review, 81, 9, pp. 76-83.
. Berry, L., Shankar, V., Parish, J., Cadwallader, S., & Dotzel, T. (2006). Creating New Markets Through Service Innovation, MIT Sloan Management Review, 47, 2, pp. 56-63

Internet Resources:

Industrial Marketing and Purchasing – Emerald database from 2015 to present (2006-2014 available at www.impgroup.org)

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Marketing B to B				
Year: 2020-21		**Programme:** BUSINESS & MANAGEMENT		
Class code: HFRMB-523EN				
Level: Master	**Year: 2**	**Period:** Spring	**Language of instruction:** English	**ECTS:** 3
Lecturer: Suela BYLYKBASHI				

Pre-requisites:

Marketing Fundamentals or International Marketing (MK301N/MK302E, MK512E or equivalent).

Learning outcomes:
At the end of the course, the student should be able to:

- Demonstrate a key expertise and a deep understanding of the concepts, methods and techniques in International Marketing

Both customers and suppliers of b2b companies are notoriously spread worldwide which make b2b marketing activities and strategies inherently international. The B2B marketing module allows students to appreciate, through use of concepts and analysis of cases, how do companies and organization operate in globalized b2b markets and equip students with skills to deal with b2b issues in international context.

MODULE INTENDED LEARNING OUTCOMES (ILOs) :

1 . Demonstrate a coherent and substantial knowledge of B2B marketing concepts and models.
2 . Accurately apply those concepts and models for analyzing value creation processes in business markets.
3. Identify and assess the recent developments in the field of B2B marketing with special attention to innovation
4 . Show familiarity with current research in the field of B2B marketing.
5 . Understand current challenges faced by B2B marketing professionals and to act upon these.

6 . Manage own learning in connection to project work

Course description:

This module examines the formulation and implementation of marketing strategy for any client when not acting as a private individual, who buys and sells products and services for an organisation. The module presents a conceptual framework that is applied and tested through the analysis of cases, real strategic problems and projects.

Topics

. Business-to-Business Markets and Marketing,
. Buyer Behaviour
. Inter-Firm Relationships and Networks,
. Business-to-Business Marketing Strategy,
. Researching Business-to-Business Markets,
. Business Market Segmentation, targeting and positioning

. Market Communication,
. Relationship Communication,
. Relationship Portfolios and Key Account Management,
. Managing Product Offerings,
. Routes to Market,
. Price-Setting in Business-to-Business Markets

Course structure and workload:

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Practical activities	12
Independent study	
Estimated personal workload	93
Total student workload	120 hours

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Group	Work in class	20%
Other assignments		
Final written report	1	60%
Project evaluation	2	20%
Total		100%

Recommended reading:

Brennan, R., Canning, L. and McDowell, R. (Latest Edition). Business-to-Business Marketing. Sage. [eBook available for previous edn].

Additional Reading

Articles and cases will be available from the Learning Center, through the Campus portal, and/or printed copies will be distributed in class.

Some major academic JOURNALS are also available in electronic format in full text via the Learning Center website. Click on “Search by title: Journals” to access “Publication Finder” then search by the title: · Industrial Marketing Management - Science Direct database from 1990 to now. · Journal of Business and Industrial Marketing - Emerald database from 1994 to now. · European Journal of Marketing Emerald database from 1989 to now. · Journal of Business-to-Business Marketing - BSC 2000 to present – embargo 18 months, but recent summaries available. ·

Internet Resources:

Industrial Marketing and Purchasing – Emerald database from 2015 to present (2006-2014 available at www.impgroup.org)

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Advanced Information Systems Management				
Year: 2020-21		**Programme:** BUSINESS & MANAGEMENT		
Class code: HFRMS-523EN				
Level: Master	**Year: 2**	**Period:** Spring	**Language of instruction:** English	**ECTS: 3**
Lecturer: Hadj BARKAT				

Pre-requisites: Introductory courses in information systems management

Learning outcomes:
The module contributes to fulfil the following program objectives and intended learning outcomes (ILOs):

As a supply chain manager he/she has to be able to propose or criticise data models to manage the development of the Information System.

Coordinated flows of data are the foundation of global supply chain management and other strategic corporate activities such as marketing and finance. Data for planning, operational monitoring, tactical decision making and performance improvement are increasingly recognised as critical factors in enterprise competitiveness. As such, IS510E Advanced Information Systems Management is centred on building student understanding of data sourcing, organisation, filtering and applying to business activities. This means the course links directly with all three GRP objectives:

- Most significant businesses and many organisations are international or global in nature, from primary suppliers through corporate projects and operations to marketing and distribution to end consumers. The data flows underlying these chains of coordinated endeavours require a shared understanding of the data and the information derived from the data.
- Businesses have multiple responsibilities: to their owners/shareholders, their employees, the host countries for their facilities and broader social goals as well (among them safety, the environment and privacy.) Good decisions and policies, especially in complex circumstances with potentially long-term consequences, require considered and expert assessment of relevant data.
- Innovation is a word that encompasses everything from strategy to processes to production to products and more. Increasingly, breakthrough products, services, pricing, distribution and service opportunities have emerged through the use of new data sources (such as Social Media, mobile devices and Internet- connected sensors), new computing power and new tools and techniques to analyse previously unimaginable volumes of data, often in near-real time.

Course description:

This course covers advanced information system management principles and techniques to provide a managerial understanding and approach. It helps students to understand the complex environments in which information systems and information technology are used with an emphasis on ways to improve organizational efficiency and effectiveness.

Course structure and workload:

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Practical activities	12
Independent study	
Estimated personal workload	93
Total student workload	120 hours

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Group	Work in class	40%
Other assignments		
Final written report	1	60%
Project evaluation		
Total		100%

Recommended reading:

-> Kenneth C & Jane P. Laudon (2019). Management Information Systems: Managing the Digital Firm. (16th edn). Pearson Education.
[eBook available for previous edn].
-> Wallace P. (2014). Introduction to Information Systems. (2nd edn). Pearson Education. [eBook available].
-> Damelio, R. (2011). The Basics of Process Mapping. (2nd edn). Productivity Press.
-> Forta, B. (2018). SAMS Teach Yourself SQL in 10 Minutes. (5th edn). Sams.
-> Davenport, T. (2014). Big Data at Work: Dispelling the Myths, Uncovering the Opportunities. Harvard University Press.

Additional Reading

-> Siegel, J.G. et al. (2003). Database management systems: A Handbook for Managers and their Advisors, Thomson South-western.

Internet Resources:
Some (not all) companies that will be used as examples and mini-case studies in class include: www.amazon.comhttp://www.tragobal.com/ http://www.sojern.com/http://www.leupold.com/ www.gnip.com http://www.google.com/analytics/

Note: This information is non-binding and can be subject to change

Contract Law in IT				
Year: 2020-21	**Programme:** BUSINESS & MANAGEMENT			
Class code: HFRCL-523EN				
Level: Master/	**Year: 2**	**Period:** Spring	**Language of instruction:** English	**ECTS: 3**
Lecturer: Dr. Anne CHOQUET				

Pre-requisites: None.

Learning outcomes:

At the end of the course, the student should be able to:

- Become a 'junior expert' in the IT business
- Links with the school GRP objective (global responsible pioneer)

Through this course, students will learn that the legal IT environment defines specific responsibilities for every actors of the IT-industry. They will understand the responsibilities of the contractual parties resulting specifically from the IT-contractual mode and/or from an IT goods and services agreement. This shall give them a solid understanding of the regulation to help them do business in the IT-sector in an appropriate and responsible manner

Course description:

The aim of this module is to examine the different types of contracts concerning IT service provision and to provide students with an early expertise in one area (sector / function-Job) consistent with their career plans: linking the IT industry knowledge and technical product knowledge with the legal and financial environment of affairs in this sector

Course structure and workload:

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Practical activities	12
Independent study	
Estimated personal workload	93
Total student workload	120 hours

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Group	Work in class	40%
Other assignments		
Final written report	1	60%
Project evaluation		
Total		100%

Recommended reading:

. Mitra, J. (2017) The business of Innovation. Sage.
. Moore, G. (2004). Inside the tornado: Strategies for Developing, Leveraging, and Surviving Hypergrowth Markets, Harpercollins Publishers.
. Christensen, Clayton M. (2011). The innovator's dilemma: The Revolutionary Book That Will Change the Way You Do Business.(Reprint). New York:Harperbusiness. [eBookavailable].

Additional Reading

. Trott, Paul (2012). Innovation management and new product development. (5th edition). [S.l.]: Prentice Hall.
. Virden, T.W. (1995). Can This High-Tech Product Sell Itself?. Harvard Business Review, 73, 6, pp. 24-28.
. Gourville, J.T. (2006). Eager Sellers and Stony Buyers. Harvard Business Review, 84, 6, pp. 98-106.
. Crossing the Chasm – A summary by Andersen.
. A Summary of Crossing the Chasm – Linowes.

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BREST CAMPUS

MASTER 2

ELECTIVE COURSE: Computer Science and Internet of Things (IoT)

Fall Semester 2021

Fall Semester 2022

Advanced Electronics For Telecommunications				
Year: 2021-22	**Programme:** COMPUTER SCIENCE AND IoT			
Class code: IOTET-512EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Maher Jridi				

Pre-requisites: Basis of digital electronics. Solid understanding of the design with FPGAs. Some knowledge of VHDL and C/C++ languages.

Learning outcomes: At the end of the course, the student should be able to:

- understand the role of electronic components used for radio receivers,
- take not of the new trends related to software defined radio (SDR),
- classify and dimension radio receiver architectures,
- understand the system on programmable chip contribution for telecommunications,
- create, package, customize IP and design and profile system performance,
- design of some functional blocks used for new radio receiver systems.

Course description: The topics covered in this class are:

Radio receivers:

- history and fundamental of radio receiver architectures
- main characteristics of 2G/3G/4G receiver architectures
- definition of receiver parameters
- use case: on the dimensioning of Bluetooth receiver

SoPC design:

- Xilinx SoPC hardware and software environments
- use of Vivado and Vivado HLS suite for fast IP design
- advanced use of HLS directives

The laboratories will include the design of functional blocks used for new radio receiver systems. Past years, labs have included the design of direct digital synthesizer (DDS), digital filters, channel coding. Applications are drawn broadly from IEEE standardization committees.

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	8
Practical activities	22
Independent study	
Estimated personal workload	30
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Theoretical written exam	1	40%
Other assignments		
Labs evaluation	4	50%
Total		**100%**

Recommended reading:

- Jridi, M. and AlFalou, A. "Direct Digital Frequency Synthesizer with CORDIC Algorithm and Taylor Series Approximation for Digital Receivers," *European Journal for Scientific Research*, Vol.30, No.4, 2009, pp. 542-553. ISSN 1450-216X
- Radio Engineering, from software radio to cognitive. Edited by Jacques Palicot, SUPELEC/IETR, Rennes, France
- Xilinx labs for design on zynq platforms

Internet Resources:

- https://www.xilinx.com/support/university/vivado/vivado-workshops.html

Note: This information is non-binding and can be subject to change

Laboratory in IoT-based LoRa Deployment				
Year: 2021-22		**Programme:** COMPUTER SCIENCE AND IoT		
Class code: IOTLO-512EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Maher Jridi				

Pre-requisites: Basis of digital electronics. Some basic knowledge on Linux administration or embedded Linux.
Learning outcomes: At the end of the course, the student should be able to:

- understand the ecosystem of IoT,
- characterize LPWAN (Low Power Wide Area Network) technologies,
- understand the radio LoRa modulation,
- dimension and design several solutions based on LoRa gateways,
- program data management with MQTT protocol and data visualization.

Course description: The topics covered in this class are:

Introduction to IoT:

- introduction to IoT ecosystem,
- overview of the enabling technologies behind the IOT,
- getting familiar with programming on raspberry-pi,

Definition of LoRa and LoRaWAN:

- definition of LPWAN (Low Power Wide Area Network),
- demystifying LoRa and LoRaWAN
- description of LoRa modulation with Matlab

Solution deployment:

- deploy LoRa based-IoT solution using Kerlink Gateway and industrial sensors
- deploy LoRa based-IoT solution using IMST Gateway
- deploy low-cost LoRa based-IoT solution using pycom sensor and gateway
- use of TTN, MQTT, Cayenne, VM for solution enhancement

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	6
Practical activities	24
Independent study	
Estimated personal workload	30
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Theoretical written exam	1	20%
Other assignments		
Labs evaluation	4	70%
Total		**100%**

Recommended reading:

- Maher Jridi, Thibault Chapel, Victor Dorez, Guénolé Le Bougeant, Antoine Le Botlan, "SoC-based Edge Computing Gateway in the Context of Internet of Multimedia Things: Experimental Platform", Journal of Low Power Electronics and Applications 2018, 8(1), 1
- Project IOT-OPEN.EU – Innovative Open Education on IoT: improving higher education for European digital global competitiveness. Erasmus+ disclaimer
- MOOC from LoRaWAN Academy: https://lora-developers.semtech.com/resources/lorawan-academy/courses/
- MOOC inria. Internet of Things with Microcontrollers: a hands-on course. https://www.fun-mooc.fr/courses/course-v1:inria+41020+session01/info

Note: This information is non-binding and can be subject to change

Image Processing				
Year: 2021-22	**Programme:** COMPUTER SCIENCE AND IoT			
Class code: IOTIP-512EN				
Level: Master	**Year**: 2	**Period**: Fall	**Language of instruction**: English	**ECTS**: 3
Lecturers: Dr Napoléon, Dr Jridi, Dr Al Falou				

Learning outcomes: At the end of the course, the student should be able to:

- understand the basis of image processing techniques and pattern recognition
- distinguish the different approaches for image and video compression and be able to compare their performance
- develop applications for image enhancement, features detection and features extraction
- be aware of the constraints linked to data variation as well as performance issues

Course description: This course is designed to provide an overview of image processing, compression algorithms and pattern recognition. It explains how to implement image enhancement, transformation, filtering and edge detection methods, how to distinguish the different approaches for image and video compression and how to compare their performance. Instruction will be given to set up detection and pattern recognition techniques and understand the constraints linked to data variation as well as performance issues.

- Image processing:
    - Introduction, human perception, color, contrast enhancement, sampling: application to watermarking
    - Thresholding, edge detection, labeling, mathematical morphology: application to projective transformation
    - Geometric transformations and filtering: application to deconvolution
- Image and video coding: introduction, principles of bitrate reduction (compression), HEVC and H264 format, performance measurements, simulations, application to the comparative study of JPEG, JPEG2000, HEVC and H264 formats
- Pattern recognition:
    - Face detection using the Viola & Jones method using Haar descriptors
    - Shape recognition methods by optical correlation: VLC, JTC, PoF
    - Recognition methods with invariance to: lighting, position, setup
    - Similarity and performance measures: PCE, ROC curves

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	30
Independent study	
Team project	20
Estimated personal workload	10
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Theoretical test	2	60%
Practical test	1	40%
Total		**100%**

Recommended reading:

- **Digital Image Processing** - Rafael C. Gonzalez et Richard E. Woods (Global Edition 2017)
- **Learn OpenCV 4 by Building Projects (Second Edition)** - David Millán Escrivá, Vinícius G. Mendonça et Prateek Joshi (Packt Publishing 2018)
- **Pattern Recognition And Machine Learning** - Christopher M. Bishop (Springer)

Note: This information is non-binding and can be subject to change

Deep Learning				
Year: 2021-22		**Programme:** COMPUTER SCIENCE AND IoT		
Class code: IOTDL-512EN				
Level: Master	**Year**: 2	**Period**: Fall	**Language of instruction**: English	**ECTS**: 3
Lecturer: Dr Napoléon, Dr Sedgh Gooya				

Pre-requisites: Algorithms, Python, Image processing

Learning outcomes: At the end of the course, the student should be able to:

- understand the theoretical principle of a neural network and its learning step
- choose the different parameters of a neural network to fit a given application
- distinguish the difference between machine learning, neural network and deep neural network
- develop neural network architecture and implement it using deep learning framewor*k*

Course description: This course is designed to provide an overview of machine learning using neural networks. It explains the fundamental principles of a neural network and how it learns. It studies the mathematical concepts allowing to implement the backpropagation of the gradient. Instruction will be given to develop neural network architecture and to implement it using deep learning frameworks.

- Neural Network:
  - Perceptron: human brain, artificial neuron, transfer functions, error correction, error measurement
  - Multilayer perceptron: principle, backpropagation, softmax, batch-processing, learning rate decay, implementation

- Deep Neural Network:
  - Convolutional neural networks: data processing, convolution layer (feature extractor), pooling layer, correction layer (ReLU), classification layer
  - Details of the different layers: dimensions, filters, steps, offset
  - Different architectures: CNN, auto-encoder, GAN, software implementation with standard frameworks
  - Transfer learning: principle, total fine-tuning, partial fine-tuning

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	30
Independent study	
Team project	20
Estimated personal workload	10
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Theoretical test	**1**	60%
Practical test	**1**	40%
Total		**100%**

Recommended reading:

- **Pattern Recognition And Machine Learning** - Christopher M. Bishop (Springer)
- **Perceptrons An Introduction to Computational Geometry** - Marvin Minsky (MIT Press)
- **Deep Learning**- Ian Goodfellow, Yoshua Bengio et Aaron Courville (MIT Press)

Note: This information is non-binding and can be subject to change

Mobile Development				
Year: 2020-21		**Programme:** COMPUTER SCIENCE AND IoT		
Class code: IOTMD-512EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Jean-Pierre Gerval				

Pre-requisites:

Good knowledge of HTML, CSS, and JavaScript languages. Skills in Java programming are welcome.

Learning outcomes:

At the end of the course, the student should be able to:

- Implement a mobile web application by exploiting the new features offered by HTML 5, CSS, and JavaScript.
- Implement a mobile application using a framework to target natively different types of OS: Android, iOS ...

Course description:

The topics covered in this class are:

HTML 5

- Specificities: Drawing on Canvas, Video and audio streaming, Drag and Drop, Geolocation, Text-to-speech, Offline storage (manifest, Local Storage, Session Storage, Web SQL)
- Reminders on responsive design concepts
- Application to mobile development (project)

PhoneGap & Cordova

- Introduction to PhoneGap & Cordova Frameworks
- Installation of tools and discovering features
- Application to mobile development (project)

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	6
Practical activities	24
Independent study	
Estimated personal workload	30
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Team written report	2	30%
Project evaluation	2	60%
Total		**100%**

Recommended reading:

- JavaScript and HTML5 Now by Kyle Simpson
- PhoneGap By Example by Andrey Kovalenko
- Apache Cordova 4 Programming (Mobile Programming) by John M. Wargo

Internet Resources:

- https://www.w3.org/TR/html52/
- https://phonegap.com/getstarted/

Note: This information is non-binding and can be subject to change

Java Web Development				
Year: 2021-22		**Programme:** COMPUTER SCIENCE AND IoT		
Class code: IOTJW-512EN				
Level: Master	**Year: 2**	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Jean-Pierre Gerval				

Pre-requisites:

Good knowledge of Java programming. Skills in the field of Data Bases are welcome.

Learning outcomes:

At the end of the course, the student should be able to know how to carry out a complete web application project with J2EE (Java Enterprise Edition) technology.

Course description:

The topics covered in this class are:

- Tomcat (Servlet Engine): presentation, installation
- Servlet: architecture, life cycle, examples
- JSP (Java Server Pages): architecture, life cycle, syntax, examples
- JSF (Java Server Faces): Installing the API, Life cycle, MVC (Model View Controller) architecture, syntax, examples

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	8
Practical activities	22
Independent study	
Estimated personal workload	30
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Team written report	1	30%
Project evaluation	1	60%
Total		**100%**

Recommended reading:

- Developing Enterprise web Applications in J2EE by Selvi Sellappan

Internet Resources:

- http://www.servlets.com/jservlet2/examples/
- http://www.tutorialspoint.com/jsp/index.htm
- http://www.tutorialspoint.com/jsf/

Note: This information is non-binding and can be subject to change

Java Frameworks				
Year: 2021-22		**Programme:** COMPUTER SCIENCE AND IoT		
Class code: IOTJF-512EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Mr. Grégory Roué				

Pre-requisites:

Good knowledge of Java programming and Java Web Development (J2EE).

Learning outcomes:

At the end of the course, the student should be able to know how to use functionalities of Spring and Hibernate frameworks in the context of creating web applications with J2EE technology.

Course description:

The topics covered in this class are:

Application development with Spring:

- Concept of software architecture, the lightweight Spring container, advanced techniques, Aspect Oriented Programming (AOP)

Web development with Spring MVC (Model View Controller):

- Initialization of Spring MVC, Controllers, JSP (Java Server Pages), JSTL (Java server page Standard Tag Library), JSTL FMT (Formatting Tag Library), Forms management

Persistence with Hibernate:

- Introduction to Hibernate, manipulation of Entity objects, relations between Entity objects, the HQL language, Session interface and Criteria object, integration with Spring

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	6
Practical activities	24
Independent study	
Estimated personal workload	30
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Quiz	1	40%
Team written report	1	10%
Project evaluation	1	40%
Total		**100%**

Recommended reading:

- Spring Security in Action by Laurentiu Spilca
- Java Persistence with Hibernate 2nd Edition by Christian Bauer

Internet Resources:

Note: This information is non-binding and can be subject to change

Laboratory project				
Year: 2021-22		**Programme:** COMPUTER SCIENCE AND IoT		
Class code: IOTLP-514EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 9
Lecturers: Dr Jean-Pierre Gerval and Dr. Maher Jridi				

Pre-requisites: Computer science courses

Learning outcomes: At the end of the laboratory project, students should be able to:

- Master project management: customer needs, feasibility study, project planning, execution, monitoring & control, reporting and deliverables
- Carry out a software project for application in research or industrial
- Perform development, conduct experiment, and test their project using software and hardware engineering tools
- Apply theoretical concepts and hands-on activities that will get students familiarized with different aspects of low-power long-range IoT technologies.

Course description: Projects offered to students change annually given the academics needs and industrial partnerships.

Course content: Non-exhaustive list of past projects:

- Students will develop a demonstrator of common types of cybersecurity attacks and hacking ...
- Students will develop an augmented reality service on smartphone allowing to associate several pieces of sugar to a food product by scanning the product barcode
- Students will develop an E-commerce web site in order to sell and to send personalized postcards using client's pictures
- Student can develop some new use cases to be integrated of the Living Lab demonstrator of L@bISEN. The Living Lab has been initially designed to maintain elderly persons by using smart cameras designed to fall detection and avoidance. The Living Lab include several sensors capable to capture data and process it to the dedicated servers.
- Student may also use the French FIT IoT Lab platform. One of the theoretical study that can be held is about the study of effect of massive IoT use in the context of smart environment or the effect of the deployment of certain modulation types on data rate, SNR, RSSI and other intrinsic parameters.
- Some part of the laboratory project may be proposed by industrial partner. Student could help to realize a part of industrial project.

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Project presentation and supervision	20
Independent study	
Team project	120
Estimated personal workload	40
Total student workload	**180 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all project meetings	10%
Other assignments		
Team written report	1	40%
Team oral presentation	1	30%
Demonstration	1	20%
Total		**100%**

Recommended reading:
The bibliography will be given at the beginning of the project

Internet Resources:
The resources will be given at the beginning of the project

Note: This information is non-binding and can be subject to change

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BREST CAMPUS

MASTER 2

ELECTIVE COURSE: Electrical Engineering

Fall Semester 2021

Fall Semester 2022

Electrical machines and drives				
Year: 2020-21		**Programme:** ELECTRICAL ENGINEERING		
Class code: ELEEM-512EM				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Yassine AMIRAT				

Pre-requisites:

Basic circuits and systems theory

Learning outcomes:

At the end of the course, the student should be able to:

- Describe the fundamental parts of electrical drives including converter, electrical machine and load.
- Explain the operating principles of induction machines, synchronous machines, switched reluctance machines and brushless dc machines
- Identify parameters in models of electrical machines.
- Analyze the steady-state behavior of electrical machines in rotor / stator reference frames
- Design a control loop in an electric drive (simulation and lab works)

Course description:

The topics covered in this class are:

- Overview of electric machines and drives
- Fundamentals of electromechanical devices (Flux linkage/current relationships, Energy, co-energy Calculation of forces and torques)
- Fundamentals of power electronics and control theory
- Synchronous machines
- Induction machines
- Brushless DC machines, Switched reluctance Machines
- Industrial applications (motoring and generating mode)

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	20
Practical activities	12
Independent study	
Estimated personal workload	28
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Team written report	4	40%
Project evaluation	1	50%
Total		**100%**

Recommended reading:

Mohan, Electric Machines and Drives: A First Course, Wiley & Sons, Inc., Hoboken, New Jersey 2011.

P.C. Sen, Principles of Electric Machines and Power Electronics, 3rd Edition, Wiley, 2013.

Note: This information is non-binding and can be subject to change

Renewable Energy Technologies				
Year: 2021-22	Programme: ELECTRICAL ENGINEERING			
Class code: ELERT-512EN				
Level: Master	**Year**: 2	**Period**: Fall	**Language of instruction**: English	**ECTS**: 3
Lecturer: Dr Zhibin ZHOU				

Pre-requisites:

Basic knowledge of electrical power conversions

Learning outcomes:

At the end of the course, the student should be able to:

- Understand power conversion and control in a renewable power system (wind, PV and marine current generation).
- Implement electrical machines and power converters in a renewable power system.

Course description:

The topics covered in this class are:

- Power conversions in wind / marine current generation
- Power conversion in solar energy (PV)
- Different generator types in wind and marine current power system
- Power converters (DC/DC, AC/DC and DC/AC) for a renewable power system
- Simulation of a marine current turbine generation system via MATLAB/Simulink (Project)

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	30
Practical activities	
Independent study	
Estimated personal workload	30
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Team written report	2	40%
Project evaluation	1	50%
Total		**100%**

Recommended reading: Electric Renewable Energy Systems, Muhammad H.Rashid, ELSEVIER Inc., 2016

Note: This information is non-binding and can be subject to change

Electric Propulsion				
Year: 2021-22	**Programme:** ELECTRICAL ENGINEERING			
Class code: ELEEP-512EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Zhibin ZHOU				

Pre-requisites:

Basic knowledge of electrical machines and electrical powers

Learning outcomes:

At the end of the course, the student should be able to:

- Size an electrical propulsion system for electrical vehicles, train and boat.
- Implement electrical machines and energy storage system for an electrical propulsion system.

Course description:

The topics covered in this class are:

- Characteristics of electrical and hybrid propulsion
- Mechanical forces required for a propulsion system
- Different electrical machines used in a propulsion system
- Sizing an electrical machine (speed and torque) for an electrical propulsion system
- Simulation for the electrical propulsion part via MATLAB/Simulink

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	20
Practical activities	
Independent study	
Estimated personal workload	40
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Team written report	2	40%
Project evaluation	1	50%
Total		**100%**

Recommended reading:

Electric Machinery (seventh edition), Fritzgerald & Kingsley, McGRAW-HILL INTERNATIONAL EDITION, 2014

Note: This information is non-binding and can be subject to change

Laboratory project				
Year: 2021-22		**Programme:** ELECTRICAL ENGINEERING		
Class code: ELELP-514EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 9
Lecturer: Dr Yassine Amirat				

Pre-requisites: Electrical engineering courses, computer sciences

Learning outcomes: At the end of the laboratory project, the students should be able to:
- Master project management: customer needs, feasibility study, project planning, execution, monitoring & control, reporting and deliverables
- Carry out an electrical engineering project for application in research or industrial
- Perform measurements, conduct experiment and test their project in research laboratory

Course description: Projects offered to students change annually given the academics needs and industrial partnerships.

Course content: Non-exhaustive list of projects. With the support of the research group, an the laboratory facilities:

- The students will develop and implement a machine current signature analysis (MCSA) algorithm for a condition monitoring system. The students will use their knowledge on signal processing combined with artificial intelligence and machine learning to provide an innovation fault detection and diagnosis system for electrical machines.
- The students will develop an underwater inductive contactless power transfer (ICPT) system for AUV charging purpose.
- The students will develop a software for optimal sizing and control of a hybrid power generation system for rural electrification.
- The students will develop and implement a grid tied converter and investigated various control algorithms in highly varying power production context.

The students will be able to do some tests on a dedicated test rig for renewable energy converter emulation.

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Project presentation and supervision	20
Independent study	
Team project	120
Estimated personal workload	40
Total student workload	**180 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all project meetings	10%
Other assignments		
Team written report	1	40%
Team oral presentation	1	30%
Demonstration	1	20%
Total		**100%**

Recommended reading:
The bibliography will be given at the beginning of the project
Internet Resources:
The resources will be given at the beginning of the project

Note: This information is non-binding and can be subject to change

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BREST CAMPUS

MASTER 2

ELECTIVE COURSE: Marine Technologies

Fall Semester 2021

Fall Semester 2022

Oceanography				
Year: 2021-22		**Programme:** MARINE TECHNOLOGIES		
Class code: MRTOC-512EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 2
Lecturer: Dr Thierry Huck				

Pre-requisites: None
Learning outcomes: At the end of the course, the student should be able to understand physical oceanography, ocean movements, waves & tides and physical processes.

Course description:
The topics covered in this class are the ocean and physical oceanography i.e. the study of physical conditions and physical processes within the ocean.

The course is intended for students wishing to acquire terminologies, discover technologies and instruments compatible in a harsh environment, with the constraints of the maritime domain.

The aim of this course is to allow the students to understand the interest of measurements, the need for environmental acquisition systems and the main objectives of oceanographic cruises.

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	12
On-board session	3
Independent study	
Estimated personal workload	15
Total student workload	**30 hours**

Course structure and workload

Physical oceanography and ocean environment:

- Ocean morphology
- Composition and properties of seawater
- Forces and constraints acting on the ocean
- Oceanic flow
- Ocean movements, waves and tides
- Ocean and climate

Assessment

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Courses evaluation 2 h	1	50%
Other assignments		
Individual report (on board session)	1	40%
Total		**100%**

Recommended reading: *Introduction to Physical Oceanography- Knauss, Garfield (2016)*
Internet Resources: None

Note: This information is non-binding and can be subject to change

Marine observatories				
Year: 2021-22	**Programme**: MARINE TECHNOLOGIES			
Class code: MRTMO-512EN				
Level: Master	**Year: 2**	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturer: Dr Joaquin Del Rio Fernandes				

Pre-requisites: None

Learning outcomes: At the end of the course, the student should be able to be knowledgeable about marine sensors, instruments and observatories.

Course description:
The topics covered in this class are the marine observatories and related technologies.

This course gives an overview about different types of sensors, instruments, platforms and ongoing projects that are providing seawater information in order to study the ocean.

In the past, human intervention was necessary to take measurements, but nowadays, cabled observatories, buoys, drifters or unmanned vehicles are performing more cost-efficient data samples.

During the course the students will perform a work in group task for the design of a cabled observatory that will be presented at the end of the course. During lectures the tools and required information will be given.

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	15
Independent study	
Team project	30
Estimated personal workload	15
Total student workload	**60 hours**

Course structure and workload

- S1: Marine observatories
- S2: Sensors and instruments
- S3: Buoys, USV and AUV
- S4: Group task for design

Assessment

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Courses evaluation 2 h	1	20%
Group task for design work	1	20%
Other assignments		
Team written report	1	20%
Individual report	1	30%
Total		**100%**

Recommended reading: *Seafloor observatories: A new vision of the earth from the abyss – Favali, Beranzoli, De santis (2015)*

Internet Resources: None

Note: This information is non-binding and can be subject to change

Underwater Instrumentation and communication				
Year: 2021-22		**Programme:** MARINE TECHNOLOGIES		
Class code: MRTUI-512EN				
Level: Master	**Year: 2**	**Period:** Fall	**Language of instruction:** English	**ECTS:** 3
Lecturers: Dr Pierre-Jean Bouvet, Dr Antony Pottier, Dr Charles Vanwynsbergue (TBC)				

Pre-requisites: Signal processing, Mathematics, Physics
Learning outcomes: At the end of the course, the student should be able to:

- be knowledgeable about underwater instrumentation and communication products
- extract, manipulate and analyse acoustic data stream for passive monitoring
- perform simple data transmission by using acoustic waves

Course description: This course is designed to provide an overview of underwater instrumentation and communication techniques.

Course content: The topics covered in this class are:

- Short conferences on underwater instrumentation products provided by companies specialized on marine technologies
- Introduction to passive acoustic monitoring
- Introduction to underwater acoustic communication

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Conference on underwater instrumentation	15
Lectures on passive acoustic monitoring	3
Lab on passive acoustic monitoring	4
Lectures on underwater acoustic communication	4
Lab on underwater acoustic communication	4
Independent study	
Team project	30
Estimated personal workload	30
Total student workload	**90 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Team written report	1	40%
Individual report	1	50%
Total		**100%**

Recommended reading:

[*1] M. Stojanovic and P.-P. J. Beaujean, "Acoustic Communication," in Springer Handbook of Ocean Engineering, M. R. Dhanak and N. I. Xiros, Eds. Springer International Publishing, 2016, pp. 359–386.*
[2] L. M. Brekhovskikh and Y. P. Lysanov, Fundamentals of Ocean Acoustics, 3rd ed. New York: Springer-Verlag, 2003.
[3] R. Otnes et al., Underwater Acoustic Networking Techniques. Berlin Heidelberg: Springer-Verlag, 2012.

Internet Resources:

Ocean explorer https://oceanexplorer.noaa.gov/explorations/sound01/background/acoustics/acoustics.html

Note: This information is non-binding and can be subject to change

Renewable Energy Technologies				
Year: 2021-22	Programme: ELECTRICAL ENGINEERING			
Class code: ELERT-512EN				
Level: Master	**Year**: 2	**Period**: Fall	**Language of instruction**: English	**ECTS**: 3
Lecturer: Dr Zhibin ZHOU				

Pre-requisites:

Basic knowledge of electrical power conversions

Learning outcomes:

At the end of the course, the student should be able to:

- Understand power conversion and control in a renewable power system (wind, PV and marine current generation).
- Implement electrical machines and power converters in a renewable power system.

Course description:

The topics covered in this class are:

- Power conversions in wind / marine current generation
- Power conversion in solar energy (PV)
- Different generator types in wind and marine current power system
- Power converters (DC/DC, AC/DC and DC/AC) for a renewable power system
- Simulation of a marine current turbine generation system via MATLAB/Simulink (Project)

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Lectures	30
Practical activities	
Independent study	
Estimated personal workload	30
Total student workload	**60 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all classes	10%
Other assignments		
Team written report	2	40%
Project evaluation	1	50%
Total		**100%**

Recommended reading: Electric Renewable Energy Systems, Muhammad H.Rashid, ELSEVIER Inc., 2016

Note: This information is non-binding and can be subject to change

Laboratory project				
Year: 2021-22	**Programme:** MARINE TECHNOLOGIES			
Class code: MRTLP-514EN				
Level: Master	**Year:** 2	**Period:** Fall	**Language of instruction:** English	**ECTS:** 9
Lecturer: Dr Yves Auffret				

Pre-requisites: Marine technologies courses, Embedded systems, Computer sciences

Learning outcomes: At the end of the laboratory project, the students should be able to:

- Master project management: customer needs, feasibility study, project planning, execution, monitoring & control, reporting and deliverables
- Carry out a marine project for application in research or industrial
- Perform measurements, conduct experiment and test their project in real condition at sea

Course description: Projects offered to students change annually given the academics needs and industrial partnerships.

Course content: Non-exhaustive list of projects. With the support of Celadon / Sea Test Base, an innovative platform for sea trials or with the framework of the instrumented marine platforms network IROMI currently deployed in the bay of Brest:

- The students will develop a detection system for marine traffic based on mixed acoustic and AIS signals. The students will use their knowledge on passive acoustic monitoring combined with artificial intelligence and machine learning to provide an innovation detection system for maritime zone guarding
- The students will develop an underwater acoustic communication system between two platforms. The students will use their knowledge on acoustic communications to provide an end-to-end undersea transmission system
- The students will develop a passive acoustics monitoring for dolphins or other marine mammals' detections and positioning

The students will be able to do some tests on a marine observatory or to do some bathymetric surveys in shallow water.

Course structure and workload

Type of pedagogic activity	No. of hours
Face-to-face	
Project presentation and supervision	20
Independent study	
Team project	120
Estimated personal workload	40
Total student workload	**180 hours**

Assessment:

Assessment type	Number of exercises	Percentage of final grade
Continuous assessment		
Participation	Ongoing in all project meetings	**10%**
Other assignments		
Team written report	1	40%
Team oral presentation	1	30%
Demonstration	1	20%
Total		**100%**

Recommended reading:
The bibliography will be given at the beginning of the project

Internet Resources:
The resources will be given at the beginning of the project

Note: This information is non-binding and can be subject to change