

## Course guide

### 295602 - DEMU - Design of Medical Wearables Devices

Last modified: 14/06/2023

**Unit in charge:** Barcelona East School of Engineering  
**Teaching unit:** 710 - EEL - Department of Electronic Engineering.  
**Degree:** BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Optional subject).  
**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish, English

#### LECTURER

**Coordinating lecturer:** Bogonez Franco, Francisco  
**Others:** Bogonez Franco, Francisco

#### PRIOR SKILLS

Knowledge of C language programming, introductory level of electronics, electronic instrumentation and biomedical signal processing. Have passed Sensors and Signals Conditions (SCSB), (SHB), (FIB) and (PSB)

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

##### Specific:

CEBIO-19. Understand physiology and biology.  
 CEBIO-22. Identify, Understand and apply the principles of sensors, conditioners and biomedical signal acquisition systems.  
 CEBIO-240. Apply analytic techniques and interpret biomedical signals and images.

CEBIO-27. Manage health and safety in hospitals.

##### Transversal:

05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.  
 07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

#### TEACHING METHODOLOGY

Lectures, cooperative work, autonomous learning and project based learning.

#### LEARNING OBJECTIVES OF THE SUBJECT

Knowledge of principles, design, risk analysis and validation of medical wearable devices.

#### STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	30,0	20.00
Hours small group	30,0	20.00

**Total learning time:** 150 h



## CONTENTS

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### Introduction

**Description:**

Definition.

Type of wearables.

Estructure/characteristics of wearable medical device.

**Full-or-part-time:** 4h

Theory classes: 4h

### Power systems

**Description:**

Batteries.

Solar energy.

Thermal energy.

Cinetic energy.

Electromagnetic energy.

**Full-or-part-time:** 4h

Theory classes: 4h

### Controller

**Description:**

Microprocessor.

Microcontroller.

FPGA.

SoC.

**Full-or-part-time:** 2h

Theory classes: 2h

### Communication protocols

**Description:**

RFID.

NFC.

BlueTooth.

LoRa.

Sigfox.

Wi-Fi.

**Full-or-part-time:** 4h

Theory classes: 4h



### Sensors

**Description:**

Temperature.  
Humidity.  
Pressure.  
ECG.  
EEG.  
EMG.  
Movement.  
Radiation.  
Pulse oximetry.

**Full-or-part-time:** 4h

Theory classes: 4h

### Development

**Description:**

Development stages.  
Standards.  
Risk management.  
Hardware.  
Software.  
Project management.

**Full-or-part-time:** 4h

Theory classes: 4h

### Cloud services

**Description:**

Introduction.  
Protocols.  
Security

**Full-or-part-time:** 4h

Theory classes: 4h

### Workspace.

**Description:**

Development board.  
Programming workspace.  
Repository.  
Cloud access.

**Full-or-part-time:** 4h

Theory classes: 4h



## GRADING SYSTEM

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Laboratory practices and project.  
The laboratory groups will be formed by 3 estudents.

## EXAMINATION RULES.

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Threes laboratory practices and 1 project.

## BIBLIOGRAPHY

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### Basic:

- Sazonov, Edward. Wearable sensors : fundamentals, implementation and applications [on line]. Academic Press, 2015 [Consultation: 26/05/2020]. Available on: <https://www.sciencedirect.com/book/9780124186620/wearable-sensors#book-info>. ISBN 978-0128192467.
- Delabrida Silva, Saul Emanuel; Rabelo Oliveira, Ricardo Augusto and Ferreira, Antonio Alfredo. Examining developments and applications of wearable devices in modern society [on line]. 2017 [Consultation: 26/05/2020]. Available on: <https://www.igi-global.com/book/examining-developments-applications-wearable-devices/180229>. ISBN 9781522532903.
- Wilson, Denise. Wearable solar cell systems [on line]. CRC Press, 2019 [Consultation: 26/05/2020]. Available on: [https://www.routledge.com/Wearable-Solar-Cell-Systems/Wilson/p/book/9780367023478?utm\\_source=crcpress.com&utm\\_medium=referral](https://www.routledge.com/Wearable-Solar-Cell-Systems/Wilson/p/book/9780367023478?utm_source=crcpress.com&utm_medium=referral). ISBN 9780367023478.
- Dey, Nilanjan; Ashour, Amira S.; Fong, Simon James and Bhatt, Chintan. Wearable and implantable medical devices : applications and challenges [on line]. 7th ed. Academic Press, 2019 [Consultation: 26/05/2020]. Available on: <https://www.elsevier.com/books/wearable-and-implantable-medical-devices/dey/978-0-12-815369-7>. ISBN 9780128153697.
- Deitel, Harvey and Deitel, Paul. C How to Program [on line]. 8th ed. Pearson, 2016 [Consultation: 30/06/2020]. Available on: <https://www.pearson.com/us/higher-education/program/Deitel-C-How-to-Program-Plus-My-Lab-Programming-with-Pearson-e-Text-Access-Card-Package-8th-Edition/PGM265656.html?tab=order>. ISBN 9780133978476.

### Complementary:

- Ghoreishizadeh, Sara; de Jager, Kylie. Circuits and systems for wearable technologies IEEE UKCAS 2019 [on line]. River Publishers, 2019 [Consultation: 26/05/2020]. Available on: [https://www.riverpublishers.com/book\\_details.php?book\\_id=757](https://www.riverpublishers.com/book_details.php?book_id=757). ISBN 9788770221320.
- Mackenzie, Brian; Galpin, Andy and White, Phil. Unplugged : evolve from technology to upgrade your fitness, performance & consciousness [on line]. Victory Belt Publishing, 2017 [Consultation: 26/05/2020]. Available on: <https://www.simonandschuster.com/books/Unplugged/Brian-MacKenzie/9781628602616>. ISBN 9781628602616.
- McCann, Jane; Bryson, David. Smart clothes and wearable technology. Boca Raton: Woodhead Publishing Ltd, 2009. ISBN 9781845693572.
- Sullivan, Scott. Designing for wearables : effective UX for current and future devices [on line]. O'Reilly Media, 2016 [Consultation: 30/06/2020]. Available on: <http://shop.oreilly.com/product/0636920047544.do>. ISBN 9781491944158.
- Wearable [on line]. [Consultation: 26/05/2020]. Available on: <https://www.wearable.com/>.