Course guide
295602 - DEMU - Design of Medical Wearables Devices

Last modified: 18/09/2024

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: 2024   **ECTS Credits:** 6.0   **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: Nescolarde Selva, Lexa Digna

Others: Nescolarde Selva, Lexa Digna

PRIOR SKILLS

Knowledge of C language programming, introductory level of electronics, electronic instrumentation and biomedical signal processing. Have passed Sensors and Signals Conditiones (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
Hours large group	45,0	30.00
Self study	90,0	60.00
Hours small group	15,0	10.00

Total learning time: 150 h

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CONTENTS

Introduction

Description:
Definition.
Type of wearables.
Estructure/característics 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.
Proyect management.

Full-or-part-time: 4h
Theory classes: 4h

Cloud services

Description:
Introduction.
Protocols.
Segurity

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

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

EXAMINATION RULES.

Threes laboratory practices and 1 project.

BIBLIOGRAPHY

Basic:
- 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.
- 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.
- 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.
- 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.
- 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. ISBN 9780367023478.

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. 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.
- 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.
- McCann, Jane; Bryson, David. Smart clothes and wearable technology. Boca Raton: Woodhead Publishing Ltd, 2009. ISBN 9781845693572.
- Wearable [on line]. [Consultation: 26/05/2020]. Available on: https://www.wareable.com/.