UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

**PHD PROGRAM IN INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING**

**PHD PROGRAM IN INFORMATION AND COMMUNICATION TECHNOLOGY FOR HEALTH**

# PhD Course announcement

## Title: Biosignals acquisition and processing

## Lecturer: Dr. Jessica Centracchio

*Università degli Studi di Napoli Federico II*
*Department of Electrical Engineering and Information Technologies (DIETI)*
*Email: jessica.centracchio@unina.it*

## Short bio notes:

Jessica Centracchio is an Assistant Professor (RTD-a) at Università degli Studi di Napoli Federico II. She holds a Ph.D. in Information Technology and Electrical Engineering, with a curriculum in biomedical engineering. Her research interests are in the fields of biomedical instrumentation and biosignals/bioimages sensing and analysis, including smart wearable sensing systems, mechanical sensing of cardiorespiratory functions, biosignal/bioimage processing methods, muscle monitoring, human-machine interfaces, prosthetics.

## Credits: 2.4

### Overview

High-quality measurement of human biosignals is of paramount importance in the large research field of information and communication technologies for health. Biosignals are very complex in nature, thus a thorough comprehension of their origins and peculiarities is instrumental in correctly interfacing with their sources to achieve high-quality measurements. This course will provide the fundamentals on the physiological origins of biosignals, as well as practical skills on best practices for biosignal acquisition, processing, and analysis through hands-on laboratory experiences.

There will be a final assessment.

## Schedule

| Lecture | Date | Time | Topics | Lecturer |
|---|---|---|---|---|
| 1 | 02/02/2026 | 9:30 – 13:30 | Introduction to biosignals, Electrocardiography (ECG), practical on ECG | Jessica Centracchio |
| 2 | 04/02/2026 | 9:30 – 13:30 | Electromyography (EMG), Forcemyography (FMG), practical on EMG and FMG | Jessica Centracchio |
| 3 | 06/02/2026 | 9:30 – 12:30 | Mechanical techniques for cardio-respiratory monitoring, practical on cardio-mechanical signals | Jessica Centracchio |
| 3 | 06/02/2026 | 12:30 – 13:30 | Assessment test | |

The lectures will be held in the SOFTEL room (1st floor, building 3, via Claudio 21, Napoli)

## Content details

**Lesson 1 – Introduction to biosignals and Electrocardiography**: The first lesson will introduce the concept of biosignal and provide an overview of the large field of human biosignals, with definitions and classifications. A special focus will be given to biopotentials, illustrating their physiological origin and information content, as well as proper methods for their acquisition. A practical session on the acquisition and processing of Electrocardiography signals will be carried out. The participants will have the opportunity to learn how to properly use an ECG recording device to acquire high-quality ECG signals, and how to process the acquired signals to extract parameters related to health status and emotional status.

**Lesson 2 – Electromyography and Forcemyography**: The second lesson will focus on biosignals related to muscle activity and their use for human-machine interfaces. Methods for electrical and mechanical monitoring of muscle contraction will be presented. A practical session will be carried out, in which the participants will learn how to properly perform Electromyography and Forcemyography measurements, and how to process these signals to extract useful parameters for human-machine interfaces, e.g., with application to gesture recognition.

**Lesson 3 – Mechanical techniques for cardio-respiratory monitoring**: The third lesson will provide the basics of cardio-respiratory monitoring techniques based on mechanical sensors, such as accelerometers, gyroscopes, force sensors, stretch sensors. Design and operation principles for their use in the recording of cardiac and respiratory biosignals will be presented, along with processing methods for the extraction of vital parameters. Then, during a practical session, the participants will have the opportunity to learn how to acquire and process cardio-respiratory biosignals from mechanical sensors, also embedded in personal devices.

## Notes

Participants are requested to bring their own notebook with MATLAB installed.

Participants are requested to send an e-mail to jessica.centracchio@unina.it by January 30, 2026, with the following information: student name and surname, name of the PhD course, PhD cycle.

For information: Dr. Jessica Centracchio (DIETI, UniNA) – jessica.centracchio@unina.it *(lecturer and organizer)*