

	<p style="text-align: center;">HO CHI MINH UNIVERSITY OF TECHNOLOGY AND EDUCATION</p> <p style="text-align: center;">FACULTY OF ELECTRICAL AND ELECTRONICS ENGINEERING</p>	<p>Programme: Biomedical Engineering</p> <p>Programme Level: Undergraduate</p>
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Syllabus

1. **Course Name:** Biomedical Sensors Instrumentation Lab
2. **Course Code:** TSEP311965
3. **Credits:** 1 credits (0:1:2) (5-hour lab session and 10 hours of self-study/week)
4. **Course Instructor(s):**
 - A. Dang-Khoa Tran, MEng
 - B. Thanh-Nghia Nguyen, MEng
 - C. Truong-Duy Nguyen, MEng
5. **Registration Requirements**
 - A. Pre-requisite Course(s): Biomedical Sensor Technology
 - B. Previous Course(s): None

6. **Course Descriptions:**

The course introduces the students to the practice and experimental studies of a wide range of biomedical sensors. Each experiment is self-contained, and the student will present the findings in written form through a lab report which will have a set of experiment-specific questions to answer. This written report also forms the basis for the assessment. All students work in groups and carry out multiple experiments, which vary based on the sensors used.

7. **Course Learning Outcomes (CLOs)**

CLOs	Descriptions <i>After completing this course, learners should be able to:</i>	ELO(s)/PI(s)	Competency
CLO1	Apply engineering-related mathematical formulae and algorithms to compute and calibrate sensors' parameters.	ELO1/PI1.3	M
CLO2	Operate DAQ hardware alongside development environments such as Arduino or LabVIEW to collect and process sensor data.	ELO2/PI2.2	M
CLO3	Apply technical knowledge and statistical software for detailed analysis and presentation of sensor data	ELO4/PI4.1	R
CLO4	Demonstrate the ability to work in a team effectively, resolve sensor-related engineering problems while demonstrating their responsibility, ethics, and contribute to the entire team's success.	ELO5/PI5.2	R

CLO5	Read and understand technical documents and terms about biomedical sensors in English.	ELO6/PI6.4	R
CLO6	Build experiment's protocols, conducting and analyzing sensor's measurements.	ELO7/PI7.1	R
	Investigate the connection and construct a sensor's hardware and software system.	ELO7/PI7.2	
	Calculate sensor parameters through the process of calibration.	ELO7/PI7.3	

Notes: I: Introduction, R: Reinforce, M: Mastery

8. Course Content

- Temperature sensor calibration and measurement by experimenting with the sensor using hot and cold water. Briefly, the work includes setting up hardware between sensor and DAQ signal receiver, setting up software simulation interface on LabVIEW to control and calculate, converting voltage signals into temperature values; comparing with standard devices; calculating errors and plotting sensor properties.
- Electrocardiogram sensor calibration, measurement, and signal preprocessing. Briefly, this lab session requires the students to set up an ECG sensor system, including ECG sensors, a DAQ device, and a PC-based development interface. Students will also be able to learn how to attach ECG electrodes onto patients correctly. Then, they will have to discuss and set up a simulation interface to acquire and preprocess the sensor's data on LabVIEW. After preprocessing, they will learn how to extract ECG features and compute the average heart rate of the ECG measurement.
- Blood pressure sensor calibration, measurement, and signal preprocessing. Students can practice with blood pressure sensors, apply in-depth application of algorithms and signal processing methods to convert voltage values into blood pressure values. Work includes setting up hardware between the sensor and DAQ receiver, applying knowledge and methods of measuring upper arm blood pressure using a cuff to immobilize the device; software setup on LabVIEW; set up experimental procedures, protocols, get results and apply algorithms to convert voltage values into blood pressure.
- Practicing with other sensors, such as O₂, EEG, MEG or force sensor.

9. Teaching Methods

- Simulation
- Presentation
- Demonstration
- Experimentation
- Group discussion

10. Student Assessments

- Grading scale: **10**
- Assessment plan:

No.	Content	CLOs	Competency	Assessment Methods	Assessment Tools	Weighting (%)
Formative Assessment						50

1	Applying mathematical formulae to compute parameters of a temperature, ECG, or blood pressure sensor.	CLO1	M	Quizzes	Rubric	10
2	Operating DAQ hardware and using LabVIEW development interface to acquire live sensor data (or simulated data) for signal processing.	CLO2	M	Quizzes Simulations	Rubric Diagram	10
3	Utilize Excel or NCSS software to perform statistical analysis on sensor data.	CLO3	R	Quizzes	Rubric	10
4	Evaluating the students' ability to carry out teamwork	CLO4	R	Performance	Rubric	10
5	Reading and understanding technical documents in English	CLO5	R	Quizzes	Rubric	10
Summative Assessment						50
6	Developing hardware or simulated systems for sensor data acquisition and preprocessing.	CLO6	I	Essay	Rubric	50

11. Learning Materials

- ThS. Trần Đăng Khoa, Giáo trình môn học TT Công nghệ Cảm biến Y sinh.

12. General Information

Academic Integrity

All students in this class are subject to HCMUTE's Academic Integrity Policy (<http://sao.hcmute.edu.vn/>) and should acquaint themselves with its content and requirements, including a strict prohibition against plagiarism. Any violations will be reported to the Faculty of Electrical and Electronic Engineering Dean's office.

Notice of Change

All information in this syllabus (other than grading and absence policies) may be subject to change with reasonable advanced notice. Students need to regularly update the information of their registered class.

Intellectual Property

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on these materials may not be sold or commercialized without the express permission of the instructor.

13. Approval Date:

14. Endorsement:

Dean of Faculty	Head of Department	Course Instructor
Assoc. Prof. Minh-Tam Nguyen	Assoc. Prof. Thanh-Hai Nguyen	

15. Revision History:

1 st Revision:	<i>Course Instructor</i> Assoc. Prof. Thanh-Hai Nguyen <i>Head of Department</i>
2 nd Revision:	<i>Course Instructor</i> Assoc. Prof. Thanh-Hai Nguyen <i>Head of Department</i>