SYLLABUS

1. **Course name:** Sensor Technology
2. **Course code:** SETE321963
3. **Credits:** 3 (3/0/6)

   Duration: 15 weeks (45h main course and 90h self-study)
4. **Instructors:**
   1- Nguyen Truong Duy, MEng.
   2- Vo Duc Dung, MEng.
5. **Course conditions**

   Prerequisites: Signals and Systems

   Corequisites: N/A
6. **Course description**

The use of many types of sensors rapidly increases in the modern technology. Currently a lot of applications related to sensors found in many different fields such as environmental technology, fabrication techniques, industrial automation and biomedical technology. Course content focuses on the theoretical basis, working principles and application of the sensors. This course also refers to the technique of measurement, sensor signal processing and sensor measurement systems.

7. **Course Goals**

Goals	***Goal description*** *(This course provides students:)*	**ELOs**
G1	Expertise in the field of sensor and measurement techniques using sensors	01 (H)
G2	An ability to collect and process signals from the sensors.	02 (H)
G3	An ability to analyze, design and operate the sensor measurement systems.	11 (M)

** Note: High: H; Medium: M; Low: L*

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

CLOs		***Description*** *(After completing this course, students can have:)*	**Outcome**
	G1.1	Presented the structure and principles of the sensors.	01
	G1.2	Presented by the principle of measuring the position, pressure, fluid flow, pressure and acceleration	01
	G1.3	Presented by measurement of the sensor signal.	01
	G2.1	Analyze operational principles of some type of sensor	02
	G2.1	Analyze operational principle of the measurement circuit and sensor applications	02

G3	G3.1	Design of signal measurement and application circuits of sensors	11

9. Study materials

- Textbooks:

[1] Nguyen Truong Duy, *Bai giang Công nghệ Cảm biến*, ĐH SPKT Tp.HCM 2017.

- References:

[2] Le Chi Kien, *Giao trinh Do luong cam bien,* NXB ĐHQG Tp.HCM 2013

10. Student Assessments

- Grading points: 10

- Planning for students assessment is followed:

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Midterms					**50**
Exam01	Classification sensor. Inductive sensor principles. Acceleration measurement principles. The principle of ultrasonic sensors.	Weeks 2, 4, 8 and 12	Quizes	G1.1 G1.2	10
Exam02	The basic concepts and principles of sensor fabrication.	week 6	Individual paper assessment in class	G1.1 G2.1	20
Exam03	Photoelectric sensors and temperature sensors	week 10	Individual paper assessment in class	G1.3 G2.1	20
Final exam					**50**
Final Exam	- The exam covers all contents related to the expected learning outcomes of the course.		Individual paper assessment in class	G1.3 G2.2 G3.1	50

11. Course details:

Weeks	Contents	CLOs
	Chapter 1: **< THE BASIC CONCEPT OF SENSORS>** *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 1.1 Mechanical sensors 1.2 Optical sensors 1.3 Using semiconductor sensors 1.4 Electrochemical sensors 1.5 Biosensors 1.6 Characteristics of the sensor 1.7 Sensor applications **Teaching methods**:	G1.1

	+ Traditional lectures + Slideshow	
	***B/* Self-study contents**: *(6)* + Look at the name and classification sensor.	G1.1
	***Chapter 2:* < PRINCIPLE OF SENSOR FABRICATION AND MEASUREMENT CIRCUITS >** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 2.1 General Principles manufacture sensors 2.2 Measuring Circuits 2.3 Measuring instruments and techniques **Teaching methods**: + Theoretical lectures + Slideshow	G1.3 G2.2
	***B/* Self-study contents**: *(6)* + Analysis of the operating principles of the measuring circuits	G2.2
	***Chapter 3:* < OPTICAL SENSORS >** *(3/0/6)*	
	A/* Contents and teaching methods:(3)* **Contents:** 3.1 Luminescent sources 3.2 Photoresistors, photoelectric cells 3.3 Classification of optical sensors **Teaching methods**: + Theoretical lectures + Questions + Slideshow	G1.1 G2.1 G3.3
	***B/* Self- study contents**: *(6)* + Look up the kinds of optical sensors. + Circuit design for optical sensor applications	G2.1 G3.1
	***Chapter 4:* < TEMPERATURE SENSORS >** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 4.1 Basic concepts 4.2 Temperature scale, standard temperature points 4.3 Thermistor sensors 4.4 Thermocouple Sensors **Teaching methods**: + Theoretical lectures + Questions + Slideshow	G1.3 G2.1 G3.1

	***B/* Self- study contents**: *(6)* + Look up the type of temperature sensors + Circuit design for temperature sensor applications	G2.1
	***Chapter 4:* < TEMPERATURE SENSORS (cont.) >** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 4.5 The pyrometer, radiation thermometer 4.6 The pressure thermometer liquid and gaseous 4.7 Temperature sensor applications **Teaching methods**: + Theoretical lectures + Questions + Slideshow	G1.3 G2.1
	***B/* Self- study contents**: *(6)* + Circuit design applications for certain types of temperature sensors	G3.1
	< EXERCISES AND TESTS > *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 1. Guided exercises 2. Tests 1 **Teaching methods**: + Questions and answers + Guide to do exercises	G1.1 G1.3 G2.1
	***B/* Self- study contents**: *(6)* + Reinforce the knowledge learned	G1.3 G2.1
	***Chapter 5:* < POSITION MEASUREMENT SENSORS >** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 5.1 Principle of position measurement 5.2 Inductive sensors 5.3 Capacitive sensors 5.4 Difference between the capacitive and inductive sensors. 5.5 Capacitive and inductive sensors applications **Teaching methods**: + Theoretical lectures + Questions + Slideshow	G2.1 G2.2 G3.1
	***B/* Self- study contents**: *(6)* + Look up the types of position measurement sensors	G1.1
	***Chapter 5:* < POSITION MEASUREMENT SENSORS (cont.) >** *(6/0/12)*	

	A/* Contents and teaching methods: (3)* **Contents:** 5.6 Mutual sensors 5.7 Hall sensors 5.8 Displacement measurement method using elastic waves **Teaching methods**: + Theoretical lectures + Question + Slideshow	G2.1 G2.2 G3.1
	***B/* Self- study contents**: *(6)* + Analysis of position measurement applications circuits	G2.2
	***Chapter 6:* < STRAIN GAUGE SENSORS >** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 6.1 Transfiguration and measurement methods 6.2 Resistive metal probe 6.3 Piezoresistive silicon sensors **Teaching methods**: + Theoretical lectures + Questions + Slideshow	G1.3 G2.2 G3.1
	***B/* Self- study contents**: *(6)* + Look up the type of sensor used to measure the deformation + Design of application circuits	G1.1 G3.1
	< EXERCISES AND TESTS > *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 1. Guided exercises 2. Tests 2 **Teaching methods**: + Questions and answers + Guide to do exercises	G1.3 G2.2 G3.1
	***B/* Self- study contents**: *(6)* + Reinforce the knowledge learned.	G1.3 G2.2
	***Chapter 7:* < PRESSURE MEASUREMENT SENSORS >** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 7.1 Pressure and pressure measurement principles 7.2 The types of pressure sensors 7.3 Piezoelectric sensors 7.4 Magnetostrictive sensors	G1.2 G2.1 G3.1

	7.5 Pressure sensor based on deformation measurements 7.6 Characteristics of pressure sensors 7.7 Pressure measurment sensor applications **Teaching methods**: + Theoretical lectures + Questions + Slideshow	
	***B/* Self- study contents**: *(6)* + Look up the type of sensor used to measure the pressure + Design of application circuits	G1.1 G3.1
	***Chapter 8:* < FLUID FLOW MEASUREMENT SENSORS >** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 8.1 Flow measurement methods. 8.2 The types of sensors used to measure fluid flows 8.3 Level sensors 8.4 Differential manometer is based on the principle of hydrostatic equilibrium. 8.5 Flow measurement by pressure difference. **Teaching methods**: + Theoretical lectures + Questions + Slideshow	G1.2 G2.2 G3.1
	***B/* Self- study contents**: *(6)* + Analysis of the principle of fluid flow measurement circuits	G1.2 G2.2
	***Chapter 9:* < VELOCITY, ACCELERATION, AND VIBRATION SENSOR >** *(3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** 9.1 Overview of MEMS 9.2 Technology MEMS fabrication products 9.3 Applications **Teaching methods**: + Theoretical lectures + Questions + Slideshow	G1.3 G2.1
	***B/* Self- study contents**: *(6)* + Presentation principles measure the velocity, acceleration and vibration. + Design of MEMS application circuits	G1.3 G3.1
	***Chapter 10:* < PROXIMITY SENSORS >** *(3/0/6)*	

	A/* Contents and teaching methods: (3)* **Contents:** 10.1 Introduction 10.2 Inductive proximity sensors 10.3 Capacitive Proximity Sensors 10.4 Optical Proximity Sensors 10.5 Ultrasonic Proximity Sensors **Teaching methods**: + Theoretical lectures + Question + Slideshow	G1.3 G2.1
	***B/* Self- study contents**: *(6)* + Look up the types of proximity sensors + Design of the application circuits	G1.1 G3.1
	***< REVIEW >** (3/0/6)*	
	A/* Contents and teaching methods: (3)* **Contents:** + Review all content **Teaching methods**: + Theoretical lectures + Question	G1.1 G2.1 G2.2 G3.1
	***B/* Self- study contents**: *(6)* + Analyzing the operation of all types of sensors + Presenting principles of measurement circuits and sensor applications	G2.1 G2.2

11 Learning ethics:

- Home assignments and projects must be done by the students themselves. Plagiarism found in the assessments will get zero point

12 First approved date: January 01 2017

13 Approval level:

Dean **Department** **Instructor**

14 Syllabus updated process

1st time: Updated content dated	Instructors
2st time: Updated content dated	Head of department