

**DEPARTAMENT:** ELECTRICAL ENGINEERING

**SUBJECT:** Sensors and Transducers

**INICIALS:** SET

**TOTAL HOURS:** 60

**THEORY:** 40 h

**PRACTICE:** 20 h

**COURSE:** Master on Electrical Engineering

**PROFESSOR/LECTURER:** PhD. Pedro Bertemes Filho ([pedro.bertemes@udesc.br](mailto:pedro.bertemes@udesc.br))

**REQUIREMENTS:** Basic knowledge on electronics

**OBJECTIVES:** Development of basic theoretical and practical skills about signal transducers; To guide the students on the specifications for using the sensors/transducers in theirs master projects.

**COURSE SYLLABUS:** Introduction on measurement systems; Temperature transducers; Strain Gauges; Position transducers; Velocity and acceleration transducers; Optical transducers; Integrated transducers; Introduction to signal conditioning.

**COURSE PROGRAM CONTENT:**

1 – Introduction on measurement systems

- Sensors X transducers
- Basic principles
- Instruments X instrumentation
- Instrument characteristics
- Linearization process
- Physical quantities and methods

2 – Transduction systems

2.1 Temperature transducers

- Resistive
- Semiconductive junction
- Thermocouple
- Integrated

2.2 Strain Gauges

- Resistive
- Semiconductive junction
- Integrated

2.3 Position transducers

- Inductive
- Capacitive
- Sincros and Resolver

2.4 Velocity and acceleration transducers

- Mechanical
- Thermistors
- Electromechanical

- Electromagnetic
  - Piezoelectric
  - Ultrasonic
- 2.5 Optical transducers
- Optical fiber
  - Transduction principles
  - Photodetectors
  - Integrated
- 2.6 Especial applications at industry
- 3 Introduction to signal conditioning circuits

**METHODOLOGY:** Expositive theoretical classes by using slides electronically projected and the white board; Practical projects in a workbench and computer simulations, when applicable; Oral presentations related to this subject.

**PERFORMANCE ASSESSMENT:** The student may decide between two methods: (1) and (2):

(1) Make 2 tests with weight 40% e 60%, respectively, **OR**

(2.1) Present a pre-project to be written in an article format. In order to be accepted as a performance assessment, it has to be orally presented after 4 weeks the class has started (10% of the final score). The expected results should be clearly defined. If the 2 students will be working in the article, then the activities of each one should be clearly described in the pre-project;

(2.2) Develop a practical/theoretical article to solve a problem in the engineering area by using the tools which will be learnt in this discipline (SET). The article should be original and it can be either proposed by the professor or by the students, once it is previously approved. The deadline of the article is the last day of the academic semester, according to the UDESC calendar, and it should be formatted according to the IEEE template (30% of the final score);

(2.3) Present the results of the article (30% of the final score).

In the case of the pre-project is not approved or the deadline was lost, the student(s) will make 2 tests, weighting 40% e 60%, respectively.

If the method (2) is chosen, a final oral presentation of the article must be done (20% of the final score) and the project/article will be 70% of the final score (10%+30%+30%).

## REFERENCES

Werneck, M. M. **Transdutores e interfaces**, Livros Técnicos e Científicos Editora, 240 pp., 1996.

Garett, P. H. **Advanced Instrumentation and Computer I/O Design: Real-Time System Computer Interface Engineering**, IEEE Press Marketing, Nova Iorque, p. 1-178, 1994.

Johnson, C. D. **Process Control Instrumentation Technology**, Prentice Hall, oitava edição, New Jersey, 694 pp., 2006.

Doebelin, E. O. **Measurement Suystems: application and design**, McGraw-Hill International Book Company, edição internacional, Singapura, 867 pp., 1983.

Groover, M. P., Weiss, M., Nagel, R. N. e Odrey, N. .G. **Industrial Robotics: technology, programming and applications**, McGraw-Hill, Inc., Nov Iorque, pp., 1986.

Nehmzow, U. **Mobile Robotics: a practical introduction**. Springer-Verlag London Limited, Londres, 243 pp., 2000.

Gorinevsky, D. M., Formalsky, A. M. e Schneider, A. Yu. **Force Control of Robotics Systems**, CRC Press, Nova Iorque, 350 pp., 1997.