

Intelligent Sensors

1. SYLLABUS INFORMATION

1.1. Course title

Intelligent Sensors

1.2. University

Pázmány Péter Catholic University

1.3. Semester

1st year, 1st semester

2. COURSE DETAILS

2.1. Course nature

Pooled elective

2.2. ECTS Credit allotment

3

2.3. Faculty data

Dr. Kovács Ferenc

3. COMPETENCES AND LEARNING OUTCOMES

3.1. Course objectives

3.2. Course contents

Main types of intelligent sensors, criteria of intelligence. Architectures. Main technologies, CMOS/LSI, surface and bulk MEMS, application of glass and plastic materials.

Typical electronic circuits, low-power low-noise preamplifiers, analog switches, RF communication circuits, E-class power amplifiers, low-power subthreshold circuits, sleep applications.

Efficient inductive power links, two- and three-way channel communications. Coupled coils. Structures of implanted inductors, on-chip RF coils. Load-shift-key backward data transfer.

Wireless strain, force, pressure and acceleration sensing. MEMS remote respiratory flow sensors. 3D tactile micro sensor and data evaluation. Cantilever and SAW applications.

Integrated multi-site microarray potentiostats. Ion-selective and CHEMFET sensors, micro hotplates for different specimens. Problems of selective gas sensing, E-nose experiments.

Wearable sensing systems for blood pressure, ECG, PCG, arterial stiffness, pulse oximetry. Body sensor networks for health care, continuous monitoring by smart phone, Biological sensors. Advanced ultra-low-power endoscopic sensors. On-chip implanted multi-site biological sensors. Bone and dental implanted sensors. Implanted multi-site neural sensors for high resolution measurement and RF transfer of actual potential. Bandwidth problems. Systems for checking the operation of different retina and cochlea implantations. Micro sensors for glaucoma test.

Home monitoring systems. Supervision of sleep using bed and floor pressure sensing elements. Remote sensors for supervision for living mode, motions, gait and irregular events, including fall detection.

Intelligent sensor networks. Models for telemedicine networks. Identification systems and sensor integration for telemedicine. Smart wireless sensor nodes for structural health monitoring.

3.3. Course bibliography

Required reading:

S. Y. Yurish, M. T. S. T Gomez: Smart Sensors and MEMS, Kluwer Academic Publ., 2004

A. Hierlemann: Integrated Chemical Microsensor Systems in CMOS Technology, Springer, 2005

F. Hu, Q. Hao: Intelligent sensor networks, CRC Press, Taylor & Francis, 2013

6 selected copies from IEEE Sensors Journal and IEEE Trans. on Biomedical Circuits and Systems

Recommended reading:

Papers from IEEE Sensors Journal and IEEE Trans. on Biomedical Engineering

4. EVALUATION

Written and oral exam