

Course title

Mechanical sensors and actuators based upon micro- and nanotechnologies

Code

SEN9010

ECTS credits	10
Faculty	Faculty of Technology and Maritime S
Location	Høgskolen i Vestfold
Teaching Language	English

Participants

Ph.D. students at HiVe and collaborating institutions

Prerequisite knowledge

Recommended prerequisite knowledge: Mathematics, Mechanics, MEMS Design and Microfabrication Methods

Aim and Objectives

Bring students up to an Advanced Level of Instrumentation with a focus on silicon micro-machined sensors and actuators based upon micro- and nanotechnologies

Objectives:

Upon completion of this course the student should be able to:

Mathematically model and analyze physical (mechanical, electrical etc.) performance of sensors and actuators

Explain operation principle, design and properties for different categories of sensors

Explain development and application of sensors and actuators implemented in micro systems

Become familiar with state-of-the art designs and process technology for microsystems

Take part in design fabrication and testing of micro sensors and actuators

Outline Syllabus

- Air damping: Squeeze film, slide film and molecular damping
- Piezoresistive pressure sensors accelerometers
- Capacitive pressure sensor and accelerometers
- Resonant sensors and vibrating gyroscopes
- Sensing circuits, signal conditioning and calibration. Noise in sensors
- Surface Micromachined Capacitive Ultrasonic Transducers
- RF MEMS resonators and filters
- MEMS switches - resistive and capacitive
- MEMS energy harvesting – piezoelectric, electromagnetic and capacitive

Work Methods/Teaching

Lectures from text book, individual/group project work, student presentation of scientific paper.

Compulsory work

For each of the 2 project works a report should be written, and an oral presentation given. Students also select a scientific paper to present.

Assessment /Method(s)

Written examination, 5 hours, 100 %.

Reading list

Mandatory reading:

M.-H. Bao: Micro Mechanical Transducers, Pressure Sensors, Accelerometers and Gyroscopes, Volum 8 in Handbook of Sensors and Actuators, ELSEVIER, Second Impression 2004.

M. –H. Bao: Analysis and Design Principles of MEMS Devices, ELSEVIER, First Edition 2005.

Supporting literature:

Yurish and Gomes "Smart sensors and MEMS" Natio Science series, Vol.181 KLuverAcademic Publishers, 2004

Kovacs: "Micromechanical Transducers Sourcebook".

S.Middelhoek, S.A.Andet:"Silicon Sensors", Academic Press London, 1989.

Ljubisa Ristic: "Sensor Technology and devices", Artech House, 1994 .

S.M.Sze: "Semiconductor Sensors", J.Wiley & Sons, 1994.

Jacob Fraden: "Handbook of modern sensors, physics, designs and applications", American Institute of Physics, ed. 2, 1997.

Coordinator (Professional responsible)

Prof. Per Øhlchers