

SYLLABUS
for the discipline:

“SMART SENSORS AND SENSOR NETWORKS”

FACULTY __ OF AUTOMATION AND COMPUTERS __
DOMAIN /SPECIALIZATION __ COMPUTER SYSTEM ENGINEERING __

Year of studies: ____ I MASTER ____

Semester: 1

Course instructor: Prof. dr. ing. Mircea POPA
Applications instructor:

Number of hours/week/Evaluation/Credits

Course	Seminar	Laboratory	Project	Evaluation	Credits
2	0	0	1	E	9

A. COURSE OBJECTIFS

- to understand the Smart sensor term; to know its characteristics, architecture, software level and applications;
- to understand the Sensor networks; to know the topics for the sensor networks: communication protocols, data gathering and processing, energy management, security, reliability and fault tolerance;
- to know examples, standards, platforms and tools for sensor networks;
- to be able to choose among different smart sensors and to establish the topics for designing a sensor network.

B. COURSE SUBJECTS

Smart sensors fundamentals: Basic sensor technolog Sensor systems; Smart sensors definitions; **Smart sensors:** Characteristics; Smart sensors architectures; Smart sensors buses and interfaces; Smart sensors software; Data acquisition methods for smart sensors; Virtual sensor systems; Smart sensors for electrical and non-electrical variables; **Sensor networks architectures:** Single node architecture; Multi node architectures; Design principles; Energy efficient topologies; Wired sensor networks and wireless sensor networks; Applications; **Communication protocols:** Physical layer; MAC protocols; Link layer protocols; Localization and positioning; Routing protocols; Transport layer; **Data gathering and processing:** Protocols for gather information; Data processing techniques; **Energy management:** Energy consumption of sensor nodes; Techniques for reducing consumption and communication energy; Energy aware routing; **Security, reliability and fault-tolerance:** Security and privacy protection; Reliability support; Fault-tolerance; **Sensor networks standards; platforms and tools:** IEEE 802.15.4 and IEEE 802.11; Berkeley motes; Operating systems.

C. APPLICATIONS SUBJECTS (laboratory; seminar; project)

Projects:

1. Smart sensors for electrical variables
2. Smart sensors for non-electrical variables
3. Study of Berkeley Motes
4. Study of Smart Dusts
5. Microsensors and MEMS
6. Operating systems for sensor networks;
7. Time synchronization and calibration in sensor networks;
8. Distributed sensor networks
9. Coverage in sensor networks
10. Localization in sensor networks
11. Data centric protocols in sensor networks
12. Routing and information aggregation in sensor networks
13. Dynamic sensor networks
14. Low power design in sensor networks
15. Minimization of consumption in sensor networks

D. REFERENCES

1. N. V. Kirianaki, S. Y. Yurish, N. O. Shpak V. P. Deynega: *Data Acquisition and Signal Processing for Smart Sensors*, John Wiley, 2004
2. H. Karl, A. Willig: *Protocols and Architectures for Wireless Sensor Networks*, John Wiley, 2005
3. M. Ilyas, I. Mahgoub (ed.): *Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems*, CRC, 2004

E. EVALUATION PROCEDURE

Exam and project each of them with 50% of the final note.

F. INTERNATIONAL COMPATIBILITY

1. *Stanford University: Sensor Networks*
2. *Lancaster Engineering University: Smart Sensors*
3. *Harvard University: Wireless Communications and Sensor Networks*

Date: 10.04.2008

HEAD OF DEPARTMENT

Prof. dr. ing. Vladimir CREȚU

COURSE INSTRUCTOR;

Prof. dr. ing. Mircea POPA