DESCRIPTION/Syllabi of Curricula/Module

Short Name of the University/Country code Date (Month / Year)	DSEA Jan 2019
TITLE OF THE MODULE	**Code**
Technologies for receiving and transmitting medical data	**P11**

Teacher(s)	Department
Coordinating: Serhii Dobriak, PhD **Others:**	Department of Computer and Information Technology (CIT)

Study cycle (BA/MA)	Level of the module (Semester number)	Type of the module (compulsary/elective)
Bachelor	8th semester (fourth year) for Bachelors	Elective

Form of delivery (theory/lab/exercises)	Duration (weeks/months)	Language(s)
Lectures, labs	15 weeks	Ukrainian / English

Prerequisites	
Prerequisites: study of the disciplines "Physics", "Electronics and computer circuitry", "Componets of modern computer systems", "Technologies of distributed systems and parallel computing".	**Co-requisites (if necessary):** none

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
4	120	52	68

Aim of the module (course unit): competences foreseen by the study program

Students should be able:

– to understand the principle of operation of micro devices, microcircuits and their use in medicine;

– to have the technical knowledge necessary for computer design, manufacture, analysis of nanostructured materials, micro-and nano-scale devices for medical use;

– to understand the term "intelligent sensor"; know its characteristics, architecture, software level and usage;

– to understand the principle of building a sensor network; know the topics for sensor networks: communication protocols, data collection and processing, energy management, security, reliability and resistance to failure in medicine.

Learning outcomes of module (course unit)	Teaching/learning methods (theory, lab, exercises)	Assessment methods (written exam, oral exam, reports)
Knowledge: - familarization with the basic theoretical principles of implementation of the methods of processing random samples and their use in specific tasks; - familiarization with the definition of different types of models, their use, testing of hypotheses, the difference between model predictions, concepts of appropriateness and model limitations.	Working with lecture notes and fundamental subject literature	Knowledge test
Skills: - formation of theoretical knowledge and practical skills in modeling and design of micro and nano scale systems for medical use; - developing of the ability to use smart sensors and sensor networks for medical use; - developing of the skills to use communication protocols.	Lectures, practical work, consultations	Active lecture attendance, lab reports
Competences: to study subject literature, share knowledge, work in a group	Lectures, practical work, consultatios	Lab reports

Themes	Contact work hours							Time and tasks for individual work	
	Lectures	Consultations	Seminars	Practiacal work	Laboratory work	Placements	**Total contact work**	**Individual work**	**Tasks**
1.Overview and Introduction. Micro and nano scale systems. Introduction to the design of MEMS and NEMS. MEMS materials for medical use.	2			2			**4**	**5**	Study exam/ Lab report
2. MEMS manufacturing technologies. Microsystem manufacturing processes. Packaging.	2			2			**4**	**5**	Study exam/ Lab report
3. Microsensors. MEMS sensors: design of acoustic wave sensors, resonant sensor, vibrating gyroscope, capacitive and piezo resistive pressure sensors - engineering mechanics behind these microsensors.	2			2			**4**	**5**	Study exam/ Lab report
4. Microactuators. Design of actuators: actuation by thermal forces, actuation by alloys with shape memory, actuation by piezoelectric crystals, actuation by electrostatic forces (parallel plate, torsion bar, combined drive actuators), micromechanical motors and pumps for medical use.	2			2			**4**	**5**	Study exam/ Lab report
5. Nano-systems and quantum mechanics. Atomic structures and quantum mechanics, molecular and nanostructure.	2			2			**4**	**5**	Study exam/ Lab report

6. Basics of smart sensors. Basic sensor technologies. Sensor systems. Definitions of smart sensors.	2			2			**4**	**5**	Study exam/ Lab report
7. Smart sensors. Characteristics; smart sensor architectures. Smart sensor buses and interfaces. Data collection methods for smart sensors. Smart sensors for electrical and non-electrical variables for medical use.	2			2			**4**	**5**	Study exam/ Lab report
8. Sensor network architectures. Single node architecture. Multi node architectures. Design principles. Energy efficient topologies. Wired sensor networks and wireless sensor networks. Applications.	2			2			**4**	**6**	Study exam/ Lab report
9. Communication protocols. Physical layer. MAC protocols. Link layer protocols. Localization and positioning. Routing protocols. Transport layer.	2			2			**4**	**6**	Study exam/ Lab report
10. Data collection and processing. Protocols for collecting information. Data processing techniques.	2			2			**4**	**6**	Study exam/ Lab report
11. Energy management. Consumption of sensor node energy. Techniques for reducing energy consumption and linking in medical sensors.	2			2			**4**	**5**	Study exam/ Lab report
12. Security, reliability and fault-resistance. Security and privacy protection. Reliability support. Fault-resistance. Sensor network standards.	2			2			**4**	**5**	Study exam/ Lab report

13. Optical sensors for biomedical applications. Wave optics. Optical sensors for measuring blood parameters. Photonic biosensors. Biosensor microsystems. Biosensors based on photonic crystals. Fluorescence sensors.	2			2			**4**	**5**	Study exam/ Lab report
Total	**26**			**26**			**52**	**68**	

Assessment strategy	**Weight in %**	**Deadlines**	**Assessment criteria**
Performance assessment	50%	During the semester	All labs should be credited
Written exam	50%	Exam	The work is done completely without mistakes

Author	**Year of issue**	**Title**	**No of periodical or volume**	**Place of printing. Printing house or internet link**
Compulsory literature				
Northrop, Robert B.	2001	Introduction to dynamic modeling of neuro-sensory systems		Biomedical engineering series (CRC Press) IISBN 0-8493-0814-3
Andreas Inmann and Diana Hodgins	2013	Implantable sensor systems for medical applications		Woodhead Publishing Limited ISBN 978-1-84569-987-1
Andrea Baschirotto, Kofi A.A. Makinwa, Pieter Harpe	2013	Frequency References, Power Management for SoC, and Smart Wireless Interfaces		Springer ISBN 978-3-319-01079-3
Andrea Baschirotto, Kofi A.A. Makinwa, Pieter Harpe	2017	Hybrid ADCs, Smart Sensors for the IoT, and Sub-1V &		Springer ISBN 978-3-319-61284-3

		Advanced Node Analog Circuit Design		
Richard C. Dorf	2006	Sensors, Nanoscience, Biomedical Engineering, and Instruments		CRC Press ISBN 0-8493-7346-8
Chong-Min Kyung, Hiroto Yasuura, Yongpan Liu, Youn-Long Lin	2017	Smart Sensors and Systems		Springer ISBN 978-3-319-33200-0
Additional literature				
R.S. Muller	1991	Microsensors		IEEEPress
Alan S Morris, Reza Langri	2015	Measurement and Instruments: Theory and Applocation		Elsevier