UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN

Faculty of Mathematics and Computer Science

Course title: COMPUTER SCIENCE IN MEDICINE AND INDUSTRY

ECTS credit allocation (and other scores): 5

Semester: autumn

Level of study: ISCED-6 - first-cycle programmes (EQF-6)

Branch of science: Natural sciences

Language: English

Number of hours per semester: 30 lectures + 30 classes = 60 hours

Course coordinator/ Department and e-mail: Erasmus coordinator Anna Szczepkowska/ WMiI, anna.szczepkowska@matman.uwm.edu.pl

Type of classes: classes and lectures

Substantive content

CLASSES:

1) The concept of analysis of experimental results by means of non-linear models 2) Introduction to the ORIGIN program - mathematical modeling and function creation 3) Creating an application for analysis of ESR and NMR data 4) Introduction to software controlling NMR and ESR experiments and equipment 5) Advanced applications using the ORIGIN program 6) Introduction to the Gaussian program - molecular structure and structure optimization 7) Gaussian - molecular modeling 8) Introduction to LabView – a creation of "Virtual Instrument" and tools for performing mathematical operations 9) LabView - creating applications for analyzing results of experiments and measurements 10) Creating an application for evaluating correlations between measured values (Excel, Matlab)

LECTURES:

1) Introduction to Magnetic Resonance Imaging 2) Application of Nuclear Magnetic Resonance and Electron Spin Resonance in medicine and industry 3) Application of molecular spectroscopy in industry 4) Mathematical methods needed for creating software applications for industry 5) Criteria of testing of numerical implementations of models of physical processes 6) Principles of molecular modelling 7) Examples of applications for data analysis collected by means of NMR and ESR methods 8) The concept of software for controlling experimental equipment 9) Methods of determining initial parameters for mathematical models of physical processes 10) Numerical analysis of correlation effects and statistical dependencies

Learning purpose:

To familiarize students with examples of software used in medicine and industry as well as the mathematical and physical foundations of effects and processes, which the software describes in order to prepare students to independently create such applications

On completion of the study programme the graduate will gain:

Knowledge:

Understanding mathematical models describing the basic physical phenomena exploited in medicine and Industry.

Ability to create applications for an analysis of physical experiments and meassurements.

Understanding the concept of software controlling experimental equipment.

Ability to test applications containing mathematical models of physical and chemical phenomena

Skills:

Ability to create an application concept for the purpose of industry or medicine applications
Ability to numerically implement models of physical processes

Social Competencies:
Ability to clearly formulate professional opinions
Ability to communicate with representatives of related disciplines

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Basic literature:

1) Hennel Jacek, Klinowski Jacek, Fundamentals of Nuclear Magnetic Resonance , wyd. Longman Pub Group, 1993, t. 1, s. 1-98; 2) Dominik Weishaupt, Victor Koechli, Borut Marincek, How does MRI work?: An Introduction to the Physics and Function of Magnetic Resonance Imaging, wyd. Springer, 2006, t. 1, s. 1-19,103-1; 3) Stewart C. Bushong, Geoffrey Clarke PhD FACMP, Magnetic Resonance Imaging: Physical and Biological Principles, wyd. Elsevier, 2003, t. 1, s. 1-91; 4) redakcja: Jerzy Hawranek, LucjanSobczyk, Zjawiska relaksacji molekularnej, wyd. Wydawnictwo Uniwersytetu Wroclawskiego, 1999, t. 1, s. 1-67; 5) Kęcki Zbigniew, Podstawy spektroskopii molekularnej , wyd. Wydawnictwo Naukowe PWN, 1998, t. 1, s. 1-105

Supplementary literature:
1) Hennel Jacek, T. Kryst-Widzgowska, Jacek Klinowski , A Primer of Magnetic Resonance Imaging, wyd. Imperial College Pr, 1998, t. 1, s. 1-85; 2) Zofia Jóźwiak, Grzegorz Bartosz, Biofizyka wybrane zagadnienia wraz z ćwiczeniami, wyd. Wydawnictwo Naukowe PWN, 2007, t. 1, s. 1-503

The allocated number of ECTS points consists of:

Contact hours with an academic teacher: 2,60 ECTS points,

Student's independent work: 2,40 ECTS points,