Faculty of Electrical Engineering, Computer Science and Telecommunications

University of Zielona Góra

INFORMATION BOOKLET

Subject Area: COMPUTER SCIENCE (INFORMATICS)

Second-cycle Level Studies
(Full-time, Part-time)
Academic Year 2011/2012

European Credit Transfer System ECTS
ECTS Course Catalogue

Computer Science (Informatics)

Second-Cycle Level Study (M.Sc. Degree)
# Table of Contents

Numerical methods  3  
Security Engineering (Information Security)  5  
Operational research  7  
Digital processing and data compression  9  
Data Warehouses  11  
Neural and neuro-fuzzy networks  13  
Digital system design  15  
Computer-aided design  17  
Virtual Reality Systems  19
SPECIALIST SUBJECTS
NUMERICAL METHODS

Course code: 11.9-WE-I-MN-PK1_S2S
Type of course: Compulsory
Entry requirements: -
Language of instruction: Polish
Director of studies: Prof. dr hab. inż. Krzysztof Gałkowski
Name of lecturer: Prof. dr hab. inż. Krzysztof Gałkowski, mgr inż. Łukasz Hładowski

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>30</td>
<td>2</td>
<td>Exam</td>
<td>7</td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td><strong>Part-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

COURSE CONTENTS:

Mathematics basics. Basic notions and theorems used in numerical analysis. Taylor series.

Numbers and Errors. Decimal, binary and hexadecimal numbers, floating point representations. Error definitions and most commonly seen error types. Ill-conditioning and numerical stability.


LEARNING OUTCOMES:
Experience in computer solving of basic computational problems in Engineering with regard limitations of floating point arithmetic.

ASSESSMENT CRITERIA:
Lecture – obtaining a positive grade in written or oral exam.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

RECOMMENDED READING:
[1] Lloyd N. Trefethen and David Bau, III: Numerical Linear Algebra, SIAM, 1997,

OPTIONAL READING:
[1] –
SECURITY ENGINEERING (INFORMATION SECURITY)

Course code: 11.9-WE-I-IB-PK3_S2S
Type of course: Compulsory
Entry requirements: -
Language of instruction: Polish
Director of studies: Prof dr hab inż. Eugeniusz Kuriata, Dr inż. Bartosz Sulikowski
Name of lecturer: Dr inż. Bartosz Sulikowski

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Semester</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Lecture</td>
<td>30</td>
<td>2</td>
<td>I</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>I</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Part-time studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Lecture</td>
<td>30</td>
<td>2</td>
<td>I</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>I</td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

COURSE CONTENTS:
System access. System access supervision. User access management. User responsibility.
Security policy. Information security administrator role and tasks.
Cryptography. Symmetric and asymmetric methods. DES, AES standards.

LEARNING OUTCOMES:
Destructive actions protection of information and applications. Legal status, laws and regulations in the field of data protection. Computer crimes survey and analysis. Active and passive defense against threats. Ways to handle with risks and their effects minimization.

ASSESSMENT CRITERIA:
Lecture – the main condition to get a pass are sufficient marks in written or oral tests conducted at least once per semester.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

RECOMMENDED READING:

OPTIONAL READING:
**OPERATIONAL RESEARCH**

Course code: 11.9-WE-I-BO-PK4_S2S

Type of course: Compulsory

Entry requirements: -

Language of instruction: Polish

Director of studies: Dr inż. Maciej Patan

Name of lecturer: Dr hab. inż. Krzysztof Patan, Dr inż. Maciej Patan

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>30</td>
<td>2</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td><strong>Part-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

**COURSE CONTENTS:**


*Network programming.* Network models with determined logical structure. CPM and PERT methods. Time-cost analysis. CPM_COST and PERT-COST methods.


LEARNING OUTCOMES:
Skills and competences in: formulating mathematical programming tasks; constructing models for optimization problems; solving linear and non-linear programming tasks with constraints; application of optimality conditions; time-cost analysis of logistic problems; algorithmic approach to determine optimal solutions; creative usage of existing numerical packages.

ASSESSMENT CRITERIA:
Lecture – the main condition to get a pass are sufficient marks in written or oral tests conducted at least once per semester.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.
Project – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

RECOMMENDED READING:

OPTIONAL READING:
[1] –
# DIGITAL PROCESSING AND DATA COMPRESSION

Course code: 11.9-WE-I-CPKD-PSW_A6_S2S  
Type of course: Compulsory  
Enter requirements: -  
Language of instruction: Polish  
Director of studies: Dr inż. Andrzej Popławski  
Name of lecturer: Dr inż. Wojciech Zając

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>30</td>
<td>2</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td><strong>Part-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

**COURSE CONTENTS:**  
Conversion AC of signal. Image and video acquisition.  
Filtration, convolution, Fourier transform.  
Discrete cosine transform.  
Discrete wavelet transform.  
Algorithms of entropy coding.  
Lossless and lossy data compression, significance of compression.  
Image quality measurements.  
Image coding standards.  
Video coding standards.

**LEARNING OUTCOMES:**  
Abilities and competence in programming of application to process the digital images and video sequences.

**ASSESSMENT CRITERIA:**  
*Lecture* – obtaining a positive grade in written or oral exam.  
*Laboratory* – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.
RECOMMENDED READING:

OPTIONAL READING:
[1] –
DATA WAREHOUSES

Course code: 11.3-WE-I-HD-PSW_A6_S2S
Type of course: Optional
Entry requirements:
Language of instruction: Polish
Director of studies: Dr hab. inż. Wiesław Miczulski, prof. UZ
Name of lecturer: Dr hab. inż. Wiesław Miczulski, prof. UZ, Dr inż. Robert Szulim

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>30</td>
<td>2</td>
<td>Exam</td>
<td>7</td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td><strong>Part-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

COURSE CONTENTS:

Introduction. Decision support systems. Operational processing versus analytical processing.

LEARNING OUTCOMES:
Skills and competences in: designing and maintaining of data warehouses, designing and conducting data analysis based on OLAP technology and selected data mining techniques.

ASSESSMENT CRITERIA:
Lecture – obtaining a positive grade in written or oral exam.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.
RECOMMENDED READING:

OPTIONAL READING:

[1] –
NEURAL AND NEURO-FUZZY NETWORKS

Course code: 11.9-WE-I-SNSR-PSW_A6_S2S
Type of course: Optional
Entry requirements: -
Language of instruction: Polish
Director of studies: Prof. dr hab. inż. Józef Korbicz
Name of lecturer: Prof. dr hab. inż. Józef Korbicz

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Semester</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>30</td>
<td>2</td>
<td>II</td>
<td>Exam</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td></td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Semester</th>
<th>Form of receiving a credit for a course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>II</td>
<td>Exam</td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td></td>
<td>Grade</td>
</tr>
</tbody>
</table>

**COURSE CONTENTS:**


**LEARNING OUTCOMES:**

Specialist subjects

algorithms, applying neural network and neuro-fuzzy networks to model nonlinear systems or pattern recognition.

ASSESSMENT CRITERIA:
Lecture – obtaining a positive grade in written or oral exam.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

RECOMMENDED READING:

OPTIONAL READING:
[1] –
DIGITAL SYSTEM DESIGN

Course code: 11.9-WE-I-PSSI-PSW_B7_S2S
Type of course: Optional
Entry requirements: -
Language of instruction: Polish
Director of studies: Prof. dr hab. inż. Alexander Barkalov
Name of lecturer: Dr inż. Grzegorz Łabiak, dr inż. Remigiusz Wiśniewski

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>15</td>
<td>1</td>
<td>Grade II</td>
<td>6</td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>Grade II</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>15</td>
<td>1</td>
<td>Grade II</td>
<td></td>
</tr>
<tr>
<td>Part-time studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>Grade II</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td>Grade II</td>
<td></td>
</tr>
</tbody>
</table>

COURSE CONTENTS:
Basic principles for control units' organization. Methods for presentation and interpretation of control algorithms; Methods of control units' organization for programmable logic devices.
Systems-on-Programmable-Chip: analysis and characteristics. Evolution of programmable logic; Foundations of System-on-Programmable-Chip; Analysis of control units as the parts of SoPC.
Design of Moore control unit. Design of Moore FSM with trivial state encoding; Design of Moore FSM with optimal state encoding; Design of Moore FSM with transformation of the code states; Design of Moore FSM with multilevel structure.
Design of microprogram control units I. Basic principles for organization and design of microprogram control units; Design of microprogram control units with natural addressing of microinstructions; Design of microprogram control units with combined addressing of microinstructions.
Design of microprogram control units II. Design of compositional microprogram control units with a base structure; Design of compositional microprogram control units with common memory; Design of compositional microprogram control units with address transformation; Design of compositional microprogram control units code sharing.

LEARNING OUTCOMES:
Skills in design of control units; synthesis and analysis of control units with different types; choice of the proper model of control unit based on analysis of the particular project requirements.
ASSESSMENT CRITERIA:
Lecture – obtaining a positive grade in written or oral exam.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.
Project – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

RECOMMENDED READING:

OPTIONAL READING:
[2] –
COMPUTER-AIDED DESIGN

Course code: 11.9-WE-I-KWP-PSW_B7_S2S
Type of course: Optional
Entry requirements: -
Language of instruction: Polish
Director of studies: dr inż. Janusz Kaczmarek
Name of lecturer: dr inż. Janusz Kaczmarek

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>15</td>
<td>1</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td>Grade</td>
<td>6</td>
</tr>
<tr>
<td>Project</td>
<td>15</td>
<td>1</td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

Full-time studies

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

Part-time studies

COURSE CONTENTS:

Introduction to the computer-aided design of electronic circuits. Historical outline. Overview of Electronic Design Automation systems. Basic notions and definitions. Imperial and metric system of units.


Printed Circuit Board designing for EMC requirements. Basic knowledge of RF emissions and susceptibility of electronic circuits. PCB EMC techniques: circuit zoning, suppressing interfaces between circuit zones, ground system, power routing and decoupling, signal routing and line termination. Signal integrity and transmission lines on PCB.


Computer simulation of thermal and electromagnetic properties of printed circuit boards.

Producing design documentation and CAM files in EDA system.
LEARNING OUTCOMES:
Know-how and competences in the field of applying Electronic Design Automation software supporting the process of designing electronic circuits with emphasis on embedded microprocessor systems.

ASSESSMENT CRITERIA:
Lecture – obtaining a positive grade in written or oral exam.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.
Project – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

RECOMMENDED READING:
2. Williams T.: The Circuit Designer’s Companion, Newnes, 2005

OPTIONAL READING:
VIRTUAL REALITY SYSTEMS

Course code: 11.3-WE-I-SWR-PSW_B7_S2S

Type of course: Optional

Entry requirements: -

Language of instruction: Polish

Director of studies: dr hab inż. Sławomir Nikiel

Name of lecturer: dr hab inż. Sławomir Nikiel

<table>
<thead>
<tr>
<th>Form of instruction</th>
<th>Number of teaching hours per semester</th>
<th>Number of teaching hours per week</th>
<th>Semester</th>
<th>Form of receiving a credit for a course</th>
<th>Number of ECTS credits allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Lecture</td>
<td>15</td>
<td>1</td>
<td>II</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>30</td>
<td>2</td>
<td></td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>15</td>
<td>1</td>
<td></td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td><strong>Part-time studies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Lecture</td>
<td>18</td>
<td>2</td>
<td>II</td>
<td>Grade</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>18</td>
<td>2</td>
<td></td>
<td>Grade</td>
<td></td>
</tr>
</tbody>
</table>

COURSE CONTENTS:

*Human factors.* Human perception, definition of human senses. Content creation process: authoring, distribution and viewing. Interaction modalities, sense of ‘presence’ in virtual environments.

*Introduction to virtual reality-related technologies:* Introduction to Virtual Environments (VE), historical background, classification, technological demands, enabling technologies, VE applications. 3D game programming environments. Application case studies in education, entertainment, architecture, industry and healthcare.

*Input/Output interfaces.* VE hardware and software: visual, audio, multimodal, haptic and olfactory interfacing. Brain-Computer Interfaces (BCI).


*Web-based VR.* Introduction to Virtual Reality Modeling Language (VRML) and eXtensible 3D (X3D). Modeling distributed VR environments (background, objects, actions).

*VR modeling tools.* Efficiency of geometrical modeling, 3D sound. Level of detail, normal mapping and progressive meshes. Scripting and PROTO-typing. XNA and shaders.
LEARNING OUTCOMES:
Analysis and design of real-time computer graphics systems, design of virtual reality systems based on X3D and XNA technologies; Preparation of media components for virtual reality applications and 3D games.

ASSESSMENT CRITERIA:
Lecture – obtaining a positive grade in written or oral exam.
Laboratory – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.
Project – the main condition to get a pass are sufficient marks for all exercises and tests conducted during the semester.

RECOMMENDED READING:

OPTIONAL READING:
[1] –