**EMaCS – European Master in Computer Science**
**Type of Project**: ERASMUS – Lifelong Learning Programme
**Project number:** 134385-LLP-1-2007-1-PT-ERASMUS-ECDSP

Institution: **West University of Timisoara**

Specialization: **Computer Science - Artificial Intelligence and Distributed Computing**

**Aim of the course**: Prepare the students to be able to use theoretical and practical tools in order to solve computational problems and design software products. A particular emphasis is put on Artificial Intelligence and Distributed Computing.

| **Artificial Intelligence** | | |
|---|---|---|
| Description:<br><br>*Objectives:* Combining theoretical and practical aspects in solving search problems; understanding heuristics; knowledge representation and reasoning; logical reasoning, pattern-oriented programming. Application of the studied concepts in problem solving, planning, games, constraint satisfaction problems, classification, expert systems etc.<br>*Content:* Problem formulation and representation; Search algorithms; Heuristics; Uninformed search; Local search; Adversial search and games; types of knowledge and representation; semantic networks; frames; probabilistic reasoning; text classification and spam filtering; rule based expert systems; expert systems generators; natural language processing. | | |
| Examination:<br><br>Final written exam (50%) + continuous assessment of lab activity (20%) + projects (30%) | | |
| 5 ECTS | 4 hours/week | 1st semester |

| **Web Technologies** | | |
|---|---|---|
| Description:<br><br>*Objectives* : provide the basic notions of technologies for web programming<br><br>*Content :* HTM, Javascript, DOM, Ajax, Servlets, JDBC, Java Server Pages, Session beans, web applications | | |
| Examination:<br><br>Final written exam (30%) + lab activity (40%) + homework (30%) | | |
| 5 ECTS | 4 hours/week | 1st semester |

| **Numerical Methods** | | |
|---|---|---|
| Description:<br>*Objective:* to provide theoretical and practical knowledge on numerical solving of problems; implementation of numerical algorithms;<br>*Content:* solving systems of linear equations (Gaussian elimination, LU / Cholesky / Householder factorization, Gauss-Seidel method); solving systems of nonlinear equations (Newton method); Interpolation and approximation; Numerical differentiation and integration; Solving differential equations. | | |
| Examination: | | |
| 5 ECTS | 4 hours/week | 1st semester |

## Software Project Management*

Description:

*Objective:* to provide fundamental theoretical knowledge of project management with an emphasis on software project management principles and specificities.

*Content:*Project management processes; Phases and lifecycle models; Project selection and initiation; Preparing the project plan; Critical path; Time and resource management plan; Communication plan; Project execution; Quality risks and performance; administrative closing, contract closing; particularities of software project management

Examination:

Final written test (40%) + continuous evaluation of lab activity (30%)+projects(30%)

| 5 ECTS | 3 hours/week | 1st semester |
|---|---|---|

## Information Management*

Description:

*Objective:* to provide knowledge about activites flow and data flow in a production company, capabilities in application design using data bases, team working

*Content:* Basic activites and process flow in production company; products design; supply management; production management and specific documents; assembly management; manufacturing management; sales management; warenhouse management; information for specific document analysis.

Examination:

Final written test (40%) and a final project(60%)

| 5 ECTS | 3 hours/week | 1st semester |
|---|---|---|

## Security and Criptography*

Description:

*Objective:*

Introduction to security and cryptography concepts. Encryption methods classification. Classical cryptography and 20th century developments in cryptography and cryptanalysis. Hash functions and digital signatures. Symmetric and asymmetric encryption algorithms. File system and network security. Viruses, trojans, spyware, scanners detection and removal. Internet specific threats.

*Content:* Cryptography and cryptanalysis; Classical cryptography, Diffie-Hellman algorithm; Hash functions - MD5, SHA-1; DES, AES, specifications and algorithms; Elements of number theory, the RSA algorithm; DSS, specification and implementation; The SSL protocol, Secure Shell; Data security, Network security ; Traffic analyzers, passwords; Torrents, the hide and seek game; Viruses, examples, protection; Trojans, examples, protection; Software exploits, Internet specific threats

| Examination: final written exam (50%) and 2 lab projects (50%) | | |
|---|---|---|
| 5 ECTS | 3 hours/week | 1st semester |

| **Diploma Stage** | | |
|---|---|---|
| Description:<br>Objective: preparing the diploma stage<br>Content: the supervisor follows the activity of the student by weekly discussions concerning the status of the diploma work | | |
| Examination:<br>The student activity is continuously evaluated by the supervisor (there is only a "passed/ not passed" evaluation not a grade) | | |
| 5 ECTS | 2 hours/week | 1st semester |

| **Graphics and User Interfaces** | | |
|---|---|---|
| Description:<br>Objectives: presenting the fundamental notions of computer graphics and programming using libraries for two and three dimensional graphics and animation<br>Content: Geometry for visualizing 3D objects (projections); Drawing graphical primitives (line and curves); 3D objects representation (constructive geometry of solid objects); Visibility algorithms; Light and shadow (illumination models); Antialiasing; Fill in algorithms; Textures; Color management; Animation; User interfaces (principles, components, design patterns) | | |
| Examination:<br>Final written exam (50%) and continuous evaluation of lab activity (50%). | | |
| 5 ECTS | 4 hours/week | 2nd semester |

| **Probability and Statistics** | | |
|---|---|---|
| Description:<br>*Objectives:* introduction in probability theory and statistics; providing probabilistic and statistical tools for solving real world problems<br>*Content :* experiments and randomevents ; sample space of an experiment ; probability ; independence and conditioning ; discrete random variables ; distribution functions ; expected values ; variants ; moments ; correlation coefficient ; random vectors ; convergence of sequences of random variables ; properties of basic distributions (binomial, multinomial, Poisson, geometric, gaussian) ; descriptive statistics ; sampling distributions ; central limit theorem ; parameters estimation ; statistical tests ; linear regression. | | |
| Examination:<br>Final written exam (50%) and continuous evaluation of the seminar (25%) and lab (50%) activities | | |
| 5 ECTS | 4 hours/week | 2nd semester |

## Distributed and Concurrent Programming**

Description:

*Objectives:* introduction to the mechanism of communication and synchronization between processes and threads and to the distributed communication mechanisms.

*Content:* Tools for Unix programming; Processes (creation, fork mechanism, program loading); Signals (signal generation and interception, blocking and unblocking UNIX signals; signal treatment); Threads (creation, inter-thread relation, termination and synchronization); Communication between threads (mutual exclusion, semaphores, condition variables, critical sections); File operation; Network communication (sockets, client server applications); Case studies (a server application, a client application)

Examination:
Written test (40%) + lab activity (40%) + project (20%)

| 5 ECTS | 3 hours/week | 2nd semester |
|---|---|---|

## Intelligent Systems**

Description:

*Objectives:* The course is intended to introduce the students into the applicative side of AI systems, namely expert systems. Expert systems are considered to be a relevant area of the intelligent systems. Languages related to the ESs development manifest a declarative nature which is important to be perceived by students using to program mostly imperative. Integration of the Ess with other application is also important as it reveals AI's utility in a broader context.
*Content:* Basic notions related to Intelligent Systems; Introduction to expert systems; Introduction to JESS/CLIPS language. Rule based systems. Pattern matching; Separating control from expertise by salience and modular design. Knowledge representation; Methods of inference (forward and backward chaining); the RETE algorithm; Integration of expert systems with other languages.

Examination:

Written exam (50%) and lab projects (50%)

| 5 ECTS | 3 hours/week | 2nd semester |
|---|---|---|

## Information Theory**

Description:

*Objectives:* Provide abilities to compute the important formulas and to apply the data compresion algorithms; to understand several definitions of information; to apply algorithms for optimal codes in data compression and data transmission.
*Content:* Fundamental measures in information theory (entropy and mutual information). Entropy rates of a stochastic process; Second law of thermodynamics; Data compression; Source coding theorem; Channel capacity; Network information theory; Kolmogorov complexity.

Examination: written exam (50%) and continuous evaluation during lab activity (50%)

| 5 ECTS | 3 hours/week | 2nd semester |
|---|---|---|

| **Network Administration**** | | |
|---|---|---|
| Description:<br>*Objectives:* Configurating a network of computers running linux/Unix OS. Configurating and installing various servers and services. Administration of a mixed network with Linux and Windows workstations<br><br>*Content:* Network administrator's tasks; User and group accoun creation; File system administration; System services configuration; Printer and mail configuration; Network interface configuration; NFS and NIS; File sharing; Samba LDAP and Kerberos; Configuration of DNS; Firewalls; Client-servere applications in C and Java. | | |
| Examination: written exam (50%) and practical exam (50%) | | |
| 5 ECTS | 3 hours/week | 2nd semester |

| **Diploma Stage** | | |
|---|---|---|
| Description:<br>*Objective:* preparing the diploma stage<br>*Content:* the supervisor follows the activity of the student by weekly discussions concerning the status of the diploma work | | |
| Examination:<br>Continuous evaluation during the semester and a final oral presentation with a jury | | |
| 5 ECTS | 2 hours/week | 2nd semester |

*The marked subjects are optional (the student should choose 2 subjects out of 3)
** The marked subjects are optional (the student should choose 3 subjects out of 4)

## Range of the marks

10: excellent
9: very good
7-8: good
5-6: sufficient
0 – 4: not passed