**ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL**
**Faculty of Electrical and Computer Engineering**
**COURSE SYLLABUS**
*Artificial Intelligence*

## 1. CODE AND NUMBER OF CREDITS

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|---|---|---|
| **CODE** | FIEC03459 | |
| **NUMBER OF CREDITS: 4** | **Theoretical:** 4 | **Practical: 0** |

## 2. COURSE DESCRIPTION

This course describes the artificial intelligence techniques as tools for analyzing and solving non-conventional problems. During the course, different knowledge representation methods are defined and identified; also, diverse mechanisms for searching and artificial reasoning are discussed and applied to solve problems. Knowledge based system architecture is analyzed as well as its development cycle.

## 3. PRE-REQUISITES AND CO-REQUISITES

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| **PRE-REQUISITES** | FIEC01552 PROGRAMMING LANGUAGES<br>FIEC06437 RESEARCH METHODS APPLIED TO COMPUTING |
| **CO-REQUISITES** | |

## 4. CORE TEXT AND OTHER REQUIRED REFERENCES FOR THE TEACHING OF THE COURSE

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| **CORE TEXT** | 1. George F. Luger, Artificial Intelligence Structures and Strategies for Complex Problem Solving, Sixth Edition, Addison Wesley, 2010. |
| **REFERENCES** | 1. Michael R. Genesereth & Nils J. Nilson, Logical Foundations of Artificial Intelligence, 2003, Morgan Kaufmann Publishers, Inc.<br>2. W. Bibel, J. Schneeberger & E. Elver, Knowledge Engineering Vol. I – Fundamentals. Representation of Knowledge, 2001, McGraw-Hill Inc.<br>3. Course notes and current papers published |

## 5. COURSE LEARNING OUTCOMES

At the end of the course, the student will be able to:

1. Know and apply different knowledge representation methods;
2. Evaluate, contrast and select the appropriate search algorithm for trees and proper artificial reasoning techniques for modeling intelligent behavior of a system, based on the definition of user and computational requirements identified during the process of analysis;
3. Design, implement and evaluate the solution of a problem based on artificial inference mechanisms.
4. The student will develop a course project working as a member of a team and will develop a technical written report, which will also be orally presented at the end of the course.

## 6. COURSE PROGRAM

I. Fundamentals of Artificial Intelligence (2 sessions: 4 hours)
- Creating a learning community, course syllabus, schedule and agenda.
- Introduction to AI, definitions and history

II. Techniques for solving AI problems and phases of development (5 sessions: 10 hours)
- Data-Driven and Goal-Driven Search
- Blind search
- Heuristic search
- A and A* type algorithms
- Admissibility Theorem
- Graphs And–Or
- Backtrack algorithm

III. Knowledge representation (3 sessions: 6 hours)
- Logic and Propositional Calculus
- Predicates
- First order predicate calculus

- Semantics in predicate calculus
- Applications
- Other knowledge representation methods
- Semantic networks, frames, rules, maps
- Comparison of knowledge representation methods

IV. Artificial reasoning and inference (2 sessions: 4 hours)
- Unification
- Inference rules
- Applications

V. The artificial reasoning process (6 sessions: 12 hours)
- The resolution theorem
- Application
- Conversion from predicates to clauses
- Answer extraction in the resolution process and refutation
- Management of uncertainty
- Cognitive Maps

VI. Production systems (1 session: 2 hours)
- Production rules representation
- Rule Based Expert Systems, advantages and disadvantages

VII. Knowledge based systems (3 sessions: 6 hours)
- Introduction to Expert Systems, characterization and structure
- Intelligent Systems development cycle

VIII. Neural networks (2 sessions: 4 hours)
- Introduction to neural networks
- Biological neural networks
- Artificial neural network, the Perceptron
- Transfer functions
- Topologies of neural networks
- Learning
- Neural networks applications
- Applications

IX. Genetic algorithms (2 sessions: 4 hours)
- Brief history
- Evolution process
- What are they and how do they work?
- Structure of the algorithm, basic concepts
- Representation methods
- Selection methodologies
- Exchange methodologies
- Advantages and limitations
- Applications

X. **Revision and evaluation of the course project** (2 sessions: 4 hours)
- Evaluation and review of project – first group
- Evaluation and review of project – second group.

## 7. WORKLOAD: THEORY/PRACTICE

Two sessions per Week, 2 hours per session
28 sessions in the semester
14 sessions per partial

## 8. CONTRIBUTION OF THE COURSE TO THE EDUCATION OF THE STUDENT

In this course different algorithms for searching trees and artificial inference based on first order logic and heuristics are analyzed.

Diverse algorithms and knowledge representation structures are revised and applied during the design of "intelligent" systems. Also, different problem solution techniques for intelligent systems are analyzed.

Students analyze and design a software solution for a real non-conventional problem, and then it is implemented based on an artificial intelligent technique.

Non-conventional advance solution techniques are analyzed, in particular for problems with uncertainty, based on programming techniques covered in previous courses.

Students present prototypes of the proposed solution before the classmates and teacher, where they have to justify the decisions taken during the design and implementation of the solution.

Students present a final written report of the project, with emphasis on what they have learned in the proposed

solution, the techniques used and results.

During the process of analysis, design and implementation, students discuss the different possibilities for implementing the project, taking into account ethic considerations and productivity once the solution is implemented.

| BASIC TRAINING | PROFESSIONAL TRAINING | SOCIAL SKILLS DEVELOPMENT |
|---|---|---|
| | X | |

**9. THE RELATIONSHIP BETWEEN THE LEARNING OUTCOMES OF THE COURSE AND THE LEARNING OUTCOMES OF THE DEGREE PROGRAM**

| LEARNING OUTCOMES OF THE DEGREE PROGRAM* | CONTRIBUTION (High, Medium, Low) | LEARNING OUTCOMES OF THE COURSE** | THE STUDENT MUST: |
|---|---|---|---|
| a) An ability to apply knowledge of computing and mathematics appropriate to the discipline | high | **2** | Evaluate, contrast and selected a search algorithm in trees and proper artificial reasoning techniques for modeling intelligent behavior of a system. |
| b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution | high | **1, 3** | Identify user and computational requirements acquired during the process of analysis and propose a design of the solution. |
| c) An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs | high | **1,3** | Design, implement and evaluate a problem solution based on artificial inference mechanisms. |
| d) An ability to function effectively on teams to accomplish a common goal. | Low | **4** | As a member of a team analyze, design and implement a solution of a problem through the semester. |
| e) An understanding of professional, ethical, legal, security, and social issues and responsibilities | Low | **4** | Identify and understand the ethical and social aspects of developing a solution of a problem, as well as the productivity and security in the context of an organization and individually. |
| f) An ability to communicate effectively with a range of audiences. | Low | **4** | Students present the products (prototype and written report) at the end of the semester, developed in a team. |
| g) An ability to analyze the local and global impact of computing on individuals, organizations and society. | ------ | | |
| h) Recognition of the need for, and an ability to engage in, continuing professional development. | ------ | | |
| i) An ability to use current techniques, skills, and tools necessary for computing practices. | Low | **1** | Identify and apply different knowledge representation methods as well as other current mechanisms and good practices for solving non-conventional problems. |
| j) An ability to lead, manage and undertake projects. | ------- | | |
| k) | | | |
| l) | | | |

## 10. EVALUATION OF THE COURSE

| Evaluation activities | |
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| Exams | X |
| Tests | X |
| Homework/tasks | X |
| Projects | X |
| Laboratory/Experiments | |
| Class participation | X |
| Visits | |
| Other | |

## 11. PERSON RESPONSIBLE FOR THE CREATION OF THE SYLLABUS AND THE DATE OF ITS CREATION

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| **Created by** | **Enrique Peláez Jarrín** |
| **Date** | **April 29, 2013** |

## 12. APPROVAL

| ACADEMIC SECRETARY OF THE ACADEMIC DEPARTMENT | DIRECTOR OF TECHNICAL ACADEMIC SECRETARY |
|---|---|
| NAME: Sra. Leonor Caicedo G. | NAME: Ing. Marcos Mendoza V. |
| SIGNATURE: | ESCUELA SUPERIOR POLITÉCNICA DEL LITORAL |
| Date of approval by the Directive Council: 2013-334 2013-08-12 | Ing. Marcos Mendoza V. DIRECTOR DE LA SECRETARIA TÉCNICA ACADÉMICA |

## 13. VALIDITY OF THE SYLLABUS

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| RESOLUTION OF THE POLYTECHNIC BOARD: | 13-10-269 |
| DATE: | 2013-10-17 |