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# NATIONAL UNIVERSITY OF SAN MARCOS

**(University of Peru,** DEAN OF AMERICA)

**FACULTY OF SYSTEMS ENGINEERING AND INFORMATICS**

***Professional Academic School of Systems Engineering***

**SYLLABUS**

**1. GENERAL INFORMATION**

**1.1 Name and code of the subject: Artificial Intelligence - 2010605**

**1.2 Number of credits: 03**

**1.3 Number of hours Per week:04 hours (2 T, 2P)**

**1.4 Cycle of study:06**

**1.5 Academic period: 2021-II**

**1.6 Requirement: (if required)Algorithmic III - 2010505**

**1.7 Professor(s): Dr.**  **Hugo Vega Huerta (Coordinator)**  **-**  **hvegah@unmsm.edu.pe**

**2. SUMILLA**

Artificial Intelligence, concepts and applications in industry and services. Representation of knowledge. Representation of AI problems as a search in the state space. Blind methods and with additional information. Expert Systems: concepts, applications and architecture. Chaining methods. Artificial neural networks based on knowledge and their applications. Introduction to intelligent systems.

**3. GENERAL COMPETENCE**

This course will contribute to the development of the following general competencies of the graduate

1. Computer Skills
2. Problem Analysis
3. Design and development of solutions
4. Individual and Team Work
5. Communication
6. Using modern tools
7. Information Systems

**4. PROGRAMMING**

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| **Didactic Unit** **1: Introduction to Artificial Intelligence** |
| **Specific competence: Comprende that is artificial intelligence and its difference with information systems, some applications in industry and services, and its difficulty in solving them through the theory of complexity of problems.** |

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| **SEM.** | **CONTENTS** | **DIDACTIC STRATEGIES** | **ACTIVITIES** | **EVALUATION** |
| 1 | |  | | --- | | **Classification of** algorithmic problems Presentation of the course. Classification of algorithmic problems, P and NP problems. Problems of decision, localization and optimization. Description of some NP-difficult issues. References: [4] Chapter 1, [1] Annex A. | | Participatory exhibition. | Theory and laboratory classes |  |
| 2 | |  | | --- | | **Fundamentals of Artificial** Intelligence Definition of Artificial Intelligence. Intelligent machine. Difference between operational systems and intelligent systems. Applications in industry and services (robotics, planning, waste management). Turing test. References: [1] Chapter 1, [2] Chapter 1, [9] Chapter 1. | | Participatory exhibition. | Exposition  Theory and laboratory classes |  |
| 3 | |  | | --- | | **Representation of human game problems – machine as search in a state space** Definition of AI problems as search problems in a state space. Representation of human–machine game problems. References: [1] Chapter 3, [3] Chapter 2, [4] Chapter 3. 1st read control | | Participatory exhibition | Exposition  Theory and laboratory classes | Presentation and group exhibition of works of  Reading |

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| **DidacticUnit**  **2: Methods ofUse** |
| **Specific competence: Designand build** intelligent systems **by applying different search methods to solve real problems. It designs and builds**  **human-machine games, which will be practically invincible by the human, for this it will define the most appropriate evaluation function and implement various intelligent decision criteria.** |

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| **SEM.** | **CONTENTS** | **DIDACTIC STRATEGIES** | **ACTIVITIES** | **EVALUATION** |
| 4 and 5 | |  | | --- | | **Blind and informed search methods** The evaluation function, blind or uninformed search methods: breadth, depth and non-deterministic, methods that use additional information: first the best, ascent to the hill, A\*, branching and dimensioning. References: [1] Chapters 3 and 4, [2] Chapter 5, [3] Chapter 3, [4] Chapters 5, [9] Chapters 9 | | Participatory exhibition. | Theory and laboratory classes |  |
| 6 | |  | | --- | | **Search methods for human-machine games** Human-machine game algorithm. Machine game strategies: non-deterministic, first the best, min-max and best difference of utilities. Min-max and alpha-beta algorithm. References: [1] Chapter 6, [2] Chapters 6, [3] Chapters 4, [4] Chapters 6, [9] Chapters 12. 2nd read control | | Participatory exhibition. | Exposition  Theory and laboratory classes | Exposition  Laboratory  Reading |
| 7 | |  | | --- | | **Presentation of computational works** Students will show their skills in the development of intelligent game software based on search techniques. A report and software must be submitted, and their work must be presented. | | Participatory exhibition | Theory and laboratory classes | Presentation of works |
| 8 | |  | | --- | | **Partial Exam** | |  |  |  |

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| **DidacticUnit**  **3: Expert Systems** |
| **Specific competence: Designs, models, and elaborates Expert Systems that provide solutions to problems of high complexity.** **It models**  **knowledge-based systems following the de facto CommonKADS methodology.** |

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| **SEM.** | **CONTENTS** | **DIDACTIC STRATEGIES** | **ACTIVITIES** | **EVALUATION** |
| 9 | |  | | --- | | **Fundamentals of expert systems** Definition of Expert Systems. Architecture of an expert system. Taxonomy and applications of expert systems. Requirements for the development of expert systems and advantages of using expert systems. Some knowledge-based problems. References: [6] Chapter 1 | | Participatory exhibition. | Theory and laboratory classes |  |
| 10 | |  | | --- | | **Knowledge Engineering** Introduction. Knowledge acquisition. The CommonKADS methodology. Design of Expert Systems (SE). Life cycle of an SE. References: [6] Chapters 6, [7] Chapters 19. | | Participatory exhibition. | Exposition  Theory and laboratory classes | Exposition  Presentation of works |
| 11 | |  | | --- | | **Knowledge Acquisition** Knowledge acquisition. Construction of the fact base and knowledge base. Knowledge representation structures (rules of inferences, frames, objects, semantic networks, logic of predicates). References: [6] Chapters 6, [7] Chapters 19. | | Participatory exhibition | Theory and laboratory classes |  |
| 12 | |  | | --- | | **Development of expert systems based on rules** Construction of the fact base and knowledge base. The inference engine. The methods of regressive, progressive and reversibility chaining. Equalization techniques, the RETE algorithm. Conflict resolution techniques. References: [1] Chapters 6 and 8, [2] Chapter 7, [6] Chapter 3, [7] Chapter 3. | | Participatory exhibition. | Theory and laboratory classes | Presentation of works |
| 13 | |  | | --- | | **Quality and validation of expert systems** Main errors in the development of an expert system. Quality of an expert system. Validation of intelligent systems, quantitative validation methods. Efficiency and error of expert systems. Review of the functionality of the SE of the 2nd work. Tasks: exercises on quality and validation of SE, validate the proposed system of the 2nd work. References: [4], [7] Chapter 21. 4th read control | | Participatory exhibition. | Exposition  Theory and laboratory classes | Laboratory Practice  Reading |
| 14 | |  | | --- | | **Introduction to Machine** Learning and heuristics. Learning and machine learning concepts. Expert systems vs machine learning. Learning techniques and machine learning development phases. Machine learning applications in industry and services. Concepts of heuristics and meta-heuristics. Exact algorithms vs heuristic algorithms. Heuristic and meta-heuristic techniques. Combinatorial optimization problems in industry and services References: [5] Chapter 1 and 2, [8] Chapter 1, [10], [11].. | | Participatory exhibition | Theory and laboratory classes | Presentation of works |
| 15 | |  | | --- | | **Presentation of computational works** Students will show their skills in the development of intelligent game software based on search techniques. A report and software must be submitted, and their work must be presented. | | Participatory exhibition | Theory and laboratory classes | Laboratory Practice |
| 16 | |  | | --- | | **Final examination** | |  |  |  |

**5. DIDACTIC STRATEGY**

The theory and practice of the subject will be developed in the classroom and the laboratory classes will be held in a personal computer room where each student has access to a computer. In theory, the method to be used is mainly expository and deductive for the formation of the concepts and their application, promoting the active intervention of the students organized in teams of 3 students, encouraging critical discussion and the approach of criteria that help raise their level of learning. Through the Virtual Classroom, students will be provided with resources such as: readings, videos and tutorials that complement the topics covered, directed practices, exercises.

In practice, the student will be provided with elaborate solution guides, while individual advice will be provided so that they can elaborate solutions to real problems.

In the laboratory sessions, computational work will be carried out, complementary exercises to the theory, and the development of an artificial intelligence programming language at a basic level such as LIPS (or a variant of it) or CLIPS seeking that students are able to create complete expert systems preferably applied to industry and services.

**Computational Works**

The students grouped into 3 will develop two computational works.

The first work is a game of human-machine interaction with the use of artificial intelligence, the game should be different from the games that exist in the media. The difference between two games is based: difference in environment, difference in rules and objects, or difference in both. The game should use the search technique in a state space, the human-machine algorithm, and should consider 3 levels of difficulty (beginner, normal and expert). It should have proper interfaces and the programming language is free.

The second job is an expert rule-based system. The knowledge base must have at least 50 rules. It must have adequate interfaces and the programming language to be used must be an AI language. As for the development, it should follow the CommonKADS methodology.

Computational works must be accompanied by a report written in the format of an article and be exposed.

**6. LEARNING ASSESSMENT**

The formula for calculating the Final Average will be as follows:

Final Average = (N1 + N2 + N3) / 3

Where:

N1 = 0.4\*Qualified Practice 1 + 0.6\*Partial Exam

N2 = 0.2\*Works + 0.3\*Final Project + 0.3\*Interventions + 0.2\*Social Responsibility Work

N3 = 0.4\*Qualified Practice 2 + 0.6\*Final Exam

No substitute exam

**7. BIBLIOGRAPHIC REFERENCES**

7.1. Basic / Specialized / Consultation

[1] STUART, RUSSELL; PETER, NORVIG

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ISBN 0-13-103805-2

[2] PATRICK, WINSTON

1984 Artificial intelligence. Ed. Addison-Wesley

ISBN 0-201-51876-7

[3] ELAINE, RICH

1988 Artificial intelligence. Ed McGraw-Hill

ISBN 0-07-450364-2

[4] DAVID, MAURITIUS

1. Notes of artificial intelligence.

[5] BONIFACIO, MARTIN; ALFREDO, SANZ

2002 Neural networks and diffuse systems. Ed. Alfaomega

ISBN 84-7897-466-0

[6] JOSEPH GIARRATANO – GARY RILEY

2001 Expert systems, principles and programming. Thomson Science Ed.

ISBN 970-686-059-2

[7] JOSÉ PALMA M., ROQUE MARIN M.

2008 Artificial intelligence, technical methods and applications. Ed. Mc Graw Hill

ISBN 978-84-484-5618-3

[8] JOSE R. HILERA, VICTOR J. MARTINE.

2000 Artificial neural networks, foundations, models and applications. Ed. Alfaomega – branch

ISBN 978-84-484-5618-3

[9] NILS J. NILSON

2001 Artificial intelligence, a new synthesis. Ed. Mc Graw Hill

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[10] CAMPELO Ruy; MACULAN Nelson.

1994, Algorithms and Heuristics. Ed. Fluminense Federal University.

GLOVER Fred; KOCHENBERGER Gary A.

[11] 2003 HandBook of Metaheuristic. Kluwer International Series.

7.2. Physical /virtual