Artificial Intelligence

1. **Course number and name:** 020IA2ES4/020AINES3 Artificial Intelligence

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours

3. **Name of course coordinator:** Youssef Bakouny

4. **Instructional materials:** PowerPoint slides; Moodle Ressources; Group Assignments

   References:
   - Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, 2020.
   - Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow, Third Edition. Aurélie Géron. O'Reilly, 2022.

5. **Specific course information**
   a. **Catalog description:**
      This course aims to study artificially intelligent agents. It portrays several methods of implementing these agents: from simple reflex agents to utility-based agents as well as learning agents. We first cover greedy and A* search, the implementation of games through the Minimax and Expectimax algorithms, Markov Decision Processes (MDP) and Reinforcement Learning (RL). We then introduce Machine Learning (ML) algorithms with some applications.

   b. **Prerequisites:** 020TROES2/020GTOES2 Graph Theory and Operational Research

   c. **Required** for students in the CCE Artificial Intelligence and Software Engineering Options; **Selected Elective** for students in the CCE Telecommunication Networks Option, and EE students.

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
      - Understand and implement artificially intelligent agents.
      - Understand, implement and evaluate search problems and heuristics.
      - Understand, implement and evaluate adversarial search algorithms.
      - Understand Markov Decision Processes (MDP)
      - Understand, implement and evaluate Reinforcement Learning (RL) algorithms.
      - Understand and apply Machine Learning (ML) algorithms.

   b. **PI addressed by the course:**

PI	1.1	1.2	1.3	2.1	2.2	2.4	4.1	4.2	7.1	7.2
Covered	x	x	x	x	x	x	x	x	x	x
Assessed	x	x	x	x	x					

7. Brief list of topics to be covered

- Intelligent agents (2 lectures)
- Greedy and A* search (2 lectures)
- Heuristics functions (1 lecture)
- Games and adversarial search (1 lecture)
- The Minimax algorithm (2 lectures)
- The Expectimax algorithm (2 lectures)
- Multiplayer games and Utilities (1 lecture)
- Monte Carlo Tree Search (1 lecture)
- Markov Decision Processes (MDP) (4 lectures)
- Reinforcement Learning (4 lectures)
- Machine Learning and Applications (4 lectures)