



**NATIONAL UNIVERSITY OF ENGINEERING  
COLLEGE OF SCIENCES  
COMPUTER SCIENCE PROGRAM**

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**CC441 – ARTIFICIAL INTELLIGENCE**

**I. GENERAL INFORMATION**

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| <b>CODE</b>           | : CC441 – Artificial intelligence   |
| <b>SEMESTER</b>       | : 7   |
| <b>CREDITS</b>        | : 4   |
| <b>HOURS PER WEEK</b> | : 6 (Theory – Laboratory)   |
| <b>PREREQUISITES</b>  | : CM274 Introduction to statistics and probabilities<br>CC301 Parallel algorithms |
| <b>CONDITION</b>      | : Mandatory   |

**II. COURSE DESCRIPTION**

This course covers fundamental topics in intelligent systems:  
Representation of knowledge and reasoning, advanced knowledge search and reasoning.  
Evaluate the possibilities of simulation of intelligence, for which the knowledge modeling techniques will be studied.  
Build a notion of intelligence that supports the tasks of its simulation.

**III. LEARNING UNITS**

**1. Fundamental Topics in Intelligent Systems**

- I: History of artificial intelligence.
- II: Philosophical issues.
- III: The Turing test.
- IV: Searle's "Chinese room" thought experiment.
- V: Typical themes in AI.
- VI: Fundamental definitions.
- VII: Optimal behavior vs. Behavior acting as a human.
- VIII: Optimal reasoning vs. reasoning acting as a human.
- IX: Philosophical questions.
- X: Modeling the world.
- XI: The role of heuristics.

**2. Search and Satisfaction of Restriction**

- I: Space problems.
- II: Search of brute force (respice first, depth first, depth first with iterative deepening).
- III: Search for the best first (best first generic, Dijkstra algorithm, A \*, admissibility of A \*).
- IV: Two-player games (minimum search, alpha-beta pruning).
- V: Restriction satisfaction (backtracking or local search methods and tracking).

### **3. Representation of Knowledge and Reasoning**

- I: Non-monotechnical inference.
- II: Probabilistic reasoning.
- III: Bayes theorem.

### **4. Advanced Search**

- I: Genetic algorithms.
- II: Simulated annealing.
- III: Local search.

### **5. Advanced Representation of Knowledge and Reasoning**

- I: Uncertainty: a) Probabilistic reasoning. b) Bayesian networks. c) Fuzzy sets and theory of possibility. d) Theory of the decision.

### **6. Agents**

- I: Definition of agents.
- II: Agent architecture: a) Simple reactive agents. b) Reactive gliders. c) Layered architectures. d) Examples of architectures and applications.
- III: Theory of agents. a) Agreements. b) Intentions. c) Theoretical-decision agents. d) Markov decision processes (PDM).
- IV: Agents that learn.
- V: Multi-agent systems. a) Multiagent systems economically inspired. b) Collaborative agents. c) Teams of agents. d) Modeling agents. e) Multiagent learning.

### **7. Natural Language Processing**

- I: Deterministic and stochastic grammar.
- II: Parsing algorithms.
- III: Corpus-based methods.
- IV: Information retrieval.
- V: Translation of language.
- VI: Speech recognition.

### **8. Machine Learning and Neural Networks**

- I: Definition and examples of machine learning.
- II: Supervised learning.
- III: Learning trees by decision.
- IV: Neural networks of learning.
- V: Learning networks by belief.
- VI: Algorithm of the nearest neighbor.
- VII: Theory of learning.

VIII: The problem of overfitting.  
IX: Unsupervised learning.  
X: Learning by reinforcement.

## 9. Robotics

I: Overview. a) Cutting-edge robot systems. b) Planning vs. Reactive control. c) Uncertainty in control. d) Senses e) Models of the world.  
II: Configuration spaces.  
III: Planning.  
IV: Sense.  
V: Robot programming.  
VI: Navigation and control.

## IV. BIBLIOGRAPHY

- Goldberg, D. Genetic Algorithms in Search, Optimization and Machine learning. Addison Wesley. 1989.
- Haykin, S. Neural networks: A Comprehensive Foundation. Prentice Hall. 1999.
- Nilsson, N. Artificial Intelligence: A new vision. McGraw-Hill 2001.
- Russell, S. and Norvig, P. Artificial Intelligence: A modern approach. Prentice Hall. 2003.
- Winston, P.H. and Horn, B.K. LISP 3a. ed .. Addison - Wesley, 1991.
- Guy L. Steele Common Lisp: The Language, 2nd edition. Publisher: Burlington, MA: Digital Press, © 1984.
- Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach: Editorial: Upper Saddle River, N.J. : Prentice Hall / Pearson Education, © 2003.
- T. Mitchell. Machine Learning McGraw Hill, 1997.
- Nilsson, Nils J. Artificial Intelligence. A new synthesis 1st Edition. McGraw Hill Interamericana de España, S.A.U. 2001.