

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department
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Study plan No.	2022/2021	University Specialization	Artificial Intelligence
Course No.	0142141	Course name	Principles of Artificial Intelligence
Credit Hours	3	Prerequisite Co-requisite	Introduction to Information Technology
Course type	<input type="checkbox"/> MANDATORY UNIVERSITY REQUIREMENT <input type="checkbox"/> UNIVERSITY ELECTIVE REQUIREMENTS	<input type="checkbox"/> FACULTY MANDATORY REQUIREMENT <input type="checkbox"/> Support course family requirements	<input type="checkbox"/> Mandatory requirements <input type="checkbox"/> Elective requirements
Teaching style	<input type="checkbox"/> Full online learning	<input type="checkbox"/> Blended learning	<input type="checkbox"/> Traditional learning
Teaching model	<input type="checkbox"/> 2Synchronous: 1asynchronous	<input type="checkbox"/> 2 face to face : 1synchronous	<input type="checkbox"/> 3 Traditional

### Faculty member and study divisions information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail	
Nagham Azmi al-madi	Associate Prof.	320	/	Nagham.a@zuj.edu.jo	
Division number	Time	Place	Number of students	Teaching style	Approved model

### Brief description

**This course aims to give an introduction to artificial intelligence, symbolic logic and its uses in knowledge representation, control methods, discretionary research methods, and applications of artificial intelligence (expert systems, natural language processing, robotics...). Introduction to Neural Networks, Genetic Algorithm, and Introduction to Machine Learning.**

### Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	1- George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving: Addison-Wesley, latest edition. ISBN 0-201-64866-0 2- Artificial Intelligence: Building Intelligent Systems. (1st edition) by P. Kulkarni and P. Joshi, PHI Learning Private Limited, 2015. ISBN: 978-81-203-5046-5
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1. Russell and Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, Inc., Prentice-Hall-Series, 2010. 2. Jeff Heaton, Artificial Intelligence for Humans, Volume.1, Fundamental Algorithms, Kindle Edition, 2013. 3. Alan Mackworth and David Poole, Artificial Intelligence: Foundations of Computational Agents, Cambridge Canada Press, 2010. 4. Robots Are People Too: How Siri, Google Car, and Artificial Intelligence Will Force Us to Change Our Laws by John F. Weaver. Praeger, Nov. 2013. ISBN: 1440829462, 9781440829468.
Supporting websites	1. Artificial Intelligence Applications Institute (AIAI) <a href="http://www.ai.ai.ed.ac.uk">http://www.ai.ai.ed.ac.uk</a> .
The physical environment for	<input type="checkbox"/> Class <input type="checkbox"/> labs <input type="checkbox"/> Virtual <input type="checkbox"/> Others

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department		
teaching	room		educational platform
Necessary equipment and software	PROLOG, JAVA, PYTHON		
Supporting people with special needs			
For technical support			

Course learning outcomes (S= Skills, C= Competences K= Knowledge,)

No.	Course learning outcomes	The associated program learning output code
<b>Knowledge</b>		
K1	1. Identify and apply knowledge representation formalisms with emphasis on propositional and predicate calculus but also with conceptual graphs, including representation of uncertainty	
K2	2. Analyse problems as state space graphs, and apply heuristic state space searches including planning using Prolog or Lisp.	
K3	3.1 Understanding the concepts of production systems. 3.2 Learning the main components of production systems.	
K4	4.1 Learning the concepts of PROLOG language. 4.2 Learning the statements, rules and queries of Prolog language.	
K5	5.1 Learning the concepts of expert systems and applications. 5.2 Learning the concepts of Knowledge Based Systems. 5.3 Learning the concepts of machine learning.	
K6	6. Evaluate a state space search algorithm in terms of admissibility, monotonicity, and informedness.	
K7	7. Analyze and evaluate expert systems.	
K8	8. Identify learning techniques: symbol based (supervised and unsupervised), reinforcement, neural networks, and genetic algorithms	
K9	9. Analyse the main approaches to natural language processing	
<b>Skills</b>		
S1	<b>Knowledge and its application.</b> Demonstrate and apply critical understanding of the artificial intelligence (AI) principles.	
S2	<b>Research skills.</b> Gain skills how to synthesize and apply theoretical knowledge of AI.	
S3	<b>Special abilities.</b> Be able to analyze the organizational capability to innovate and provide recommendations from an AI perspective.	
S4	<b>Social abilities.</b> Adhere to the principles of professional ethics and citizenship participating in discussions on relevant academic issues. Be able to lead the team and be accountable for its performance.	
S5	<b>Personal abilities.</b> Develop personal and professional abilities, critical thinking, and creativity.	
<b>Competences</b>		
C1	Use programming languages	
C2	Solve computer problems with Math	
C3	Exploit the principle of object-oriented programming	

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department	
C4	Develop transactional web applications	
C5	Develop game or simulation applications	

### Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
First exam				
Second / midterm exam			%30	
Participation / practical applications				
Asynchronous interactive activities			%20	
final exam			%50	

**Note:** Asynchronous interactive activities are activities, tasks, projects, assignments, research, studies, projects, work within student groups ... etc, which the student carries out on his own, through the virtual platform without a direct encounter with the subject teacher.

### Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style*	Reference **
1	1. AI: HISTORY AND APPLICATIONS 1.1. Attitudes toward Intelligence, Knowledge, and Human Artifice 1.2. Overview of AI Application Areas 1.3. Artificial Intelligence: An Attempted Definition	<ul style="list-style-type: none"> <li>Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving.
2	2. THE PREDICATE CALCULUS 2.1. The Propositional	<ul style="list-style-type: none"> <li>Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> </ul>	George F. Luger. Artificial Intelligence:

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department		
	Calculus 2.2. The Predicate Calculus 2.3. Using Inference Rules to Produce Predicate Calculus Expressions	<ul style="list-style-type: none"> <li>slides</li> </ul>	Structures and Strategies for Complex Problem Solving
3	3. STRUCTURES AND STRATEGIES FOR STATE SPACE SEARCHES 3.1. Graph Theory 3.1.1. Structures for State Space Searches 3.1.2. State Space Representations of Problems 3.2. Strategies for State Space Searches 3.2.1. Data-Driven and Goal-Driven Searches 3.2.2. Depth-First and Breadth-First Searches 3.3. Using the State Space to Represent Reasoning 3.3.1. State Space Descriptions of a Logical System 3.3.2. And/Or Graphs	Classroom <ul style="list-style-type: none"> <li>lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving
4	4. HEURISTIC SEARCHES 4.1. "Best-First" Searches 4.2. Heuristic Searches and Expert Systems 4.3. Admissibility, Monotonicity,	<ul style="list-style-type: none"> <li>Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for

QF01/0408-4.0E		Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department	
	Informedness 4.4. Heuristics in Games 4.4.1. The Minimax Procedure 4.4.2. The Alpha-Beta Procedure 4.5. Complexity Issues		Complex Problem Solving
5	<b>Revision</b> <b>Midterm exam</b> <b>30%</b>		
6	5. CONTROL AND IMPLEMENTATION OF STATE SPACE SEARCHES 5.1. Recursion-Based Searches 5.2. Pattern-Directed Searches 5.3. Production Systems 5.4. The Blackboard Architecture for Problem Solving	<ul style="list-style-type: none"> <li>Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving
7	6. KNOWLEDGE REPRESENTATION 6.1. AI Representational Schemes 6.1.1. Semantic Networks 6.1.2. Scripts, Frames 6.2. Conceptual Graphs 6.2.1. Types, Individuals, and Names 6.2.2. The Type Hierarchy 6.2.3. Generalization	<ul style="list-style-type: none"> <li>Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department		
	and Specialization 6.2.4. Propositional Nodes 6.2.5. Logic 6.3. Alternatives to Explicit Representation 6.4. Agent-Based and Distributed Problem Solving		
8	7. STRONG METHOD PROBLEM SOLVING 7.1. Expert Systems Technology 7.2. Rule-Based Expert Systems 7.2.1. Goal- Driven and Data- Driven Reasoning 7.2.2. Heuristics and Control 7.3. Model-Based, Case-Based, and Hybrid Systems 7.4. Planning	<ul style="list-style-type: none"> <li>• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>• slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving
9	8. REASONING UNDER UNCERTAINTY 8.1. Logic-Based Abductive Inferences 8.2. Abduction: Alternatives to Logic 8.2.1. The Stanford Certainty Factor 8.2.2. Fuzzy Sets 8.2.3. The Dempster-Shafer Theory of Evidence 8.3. The Stochastic Approach to Uncertainty	<ul style="list-style-type: none"> <li>• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>• slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving  Artificial Intelligence: Building Intelligent Systems.

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department		
10	9. LANGUAGES AND PROGRAMMING TECHNIQUES FOR ARTIFICIAL INTELLIGENCE 9.1. Prolog Implementation 9.1.1. Syntax for Predicate Calculus Programming 9.1.2. Lists and Recursions 9.1.3. Search Controls 9.1.4. Abstract Data Types 9.2. LISP Implementation (Overview)	Classroom <ul style="list-style-type: none"> <li>lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving  Artificial Intelligence: Building Intelligent Systems.
11	10. UNDERSTANDING NATURAL LANGUAGE 10.1. Deconstructing Language 10.2. Syntax 10.2.1. Specification and Parsing Using Context-Free Grammars 10.2.2. Transition Network Parsers 10.2.3. The Chomsky Hierarchy and Context-Sensitive Grammars 10.2.4. ATN Parsers 10.3. Stochastic Tools for Language Analysis (Overview) 10.4. Natural Language	Classroom <ul style="list-style-type: none"> <li>lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving  Artificial Intelligence: Building Intelligent Systems.

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department		
12	<p>Applications</p> <p>11. MACHINE LEARNING: SYMBOL-BASED</p> <p>11.1. A Framework for Symbol-Based Learning</p> <p>11.2. Version Space Searches</p> <p>11.3. The ID3 Decision Tree Induction Algorithm (Overview)</p> <p>11.4. Inductive Bias and Learnability</p> <p>11.5. Knowledge and Learning</p> <p>11.5.1. Meta-DENDRAL</p> <p>11.5.2. Explanation-Based Learning</p> <p>11.5.3. EBL and Knowledge-Level Learning</p> <p>11.5.4. Analogical Learning</p> <p>11.6. Unsupervised Learning</p> <p>11.6.1. Discovery</p> <p>11.6.2. Conceptual Clustering</p> <p>11.6.3. COBWEB (Overview)</p> <p>11.7. Reinforcement Learning</p>	<ul style="list-style-type: none"> <li>• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>• slides</li> </ul>	<p>George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving</p>
13	<p>12. MACHINE LEARNING: CONNECTIONIST</p> <p>12.1. Foundations for Connectionist Networks</p> <p>12.2. Perceptron Learning</p> <p>12.3. Backpropagation Learning</p> <p>12.4. Competitive</p>	<ul style="list-style-type: none"> <li>• Classroom lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>• slides</li> </ul>	<p>George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving</p>



QF01/0408-4.0E		Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department	
	Learning 12.4.1. A Kohonen Network 12.4.2. Outstar Networks and Counterprobagation 12.5. Hebbian Coincidence of Learning (Overview) 12.6. Attractor Networks or "Memories" (Overview)		
14	13. MACHINE LEARNING: SOCIAL AND EMERGENT 13.1. The Genetic Algorithm 13.2. Classifier Systems and Genetic Programming 13.3. Artificial Life and Society-Based Learning 13.3.1. The Game of Life 13.3.2. Evolutionary Programming	<ul style="list-style-type: none"> <li>lectures, discussions, and review of theoretical concepts. Laboratory practical sessions.</li> <li>slides</li> </ul>	Classroom George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving
15	<b>Final Exam 50%</b>		

\* Learning styles: Lecture, flipped learning, learning through projects, learning through problem solving, participatory learning ... etc.

\*\* Reference: Pages in a book, database, recorded lecture, content on the e-learning platform, video, website ... etc.

### Schedule of asynchronous interactive activities (in the case of e-learning and blended learning)

Week	Task / activity	Reference	Expected results
1			
2			
3			
4			
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8			

شعار الكلية

جامعة الزيتونة الأردنية  
Al-Zaytoonah University of Jordan  
كلية العلوم وتكنولوجيا المعلومات  
Faculty of Science and Information  
Technologz



"عراقة وجودة"  
"Tradition and Quality"

QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Artificial Intelligence Department		
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