جامعــة الزيتونـــة الأردنيــة
Al−Zaytoonah University of Jordan
كلية العلوم وتكنولوجيا المعلومات
Faculty of Science and Information Technology

" عراقة وجودة"
"Tradition and Quality"

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

Study plan No.	2021\2022		University Specialization		Artificial intelligence
Course No.	0142340		Course name		Cognitive and Knowledge Science
Credit Hours	3 hours		Prerequisite Co-requisite		Principles of Artificial Intelligence
Course type	☐ MANDATORY UNIVERSITY REQUIREMENT	☐ UNIVERSITY ELECTIVE REQUIREMENTS	☐ FACULTY MANDATORY REQUIREMENT	☐ Support course family requirements / ☐ √ Mandatory requirements	☐ Elective requirements
Teaching style	☐ Full online learning		☐ √ Blended learning		☐ Traditional learning
Teaching model	☐ 2Synchronous: 1asynchronous		☐ √ 2 face to face : 1synchronous		☐ 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

Division number	Time	Place	Number of students	Teaching style	Approved model

Brief description

This course covers all the concepts of building knowledge-based systems and structured knowledge representations. In addition, it covers all the knowledge-based methods of knowledge representations, reasoning, problem solving, planning, decision-making, and learning. This is a core course in artificial intelligence (AI), where students learn how to design knowledge-based and cognitive AI agents and a knowledge structure integrated with production.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	Knowledge Representation and Reasoning / Ronald J. Brachman, Hector J. Levesque, and Maurice Pagnucco 1st edition, 2015.
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1. Knowledge-based Systems/ Rajendra Akerkar and Priti Sajja, 2010. 2. Prolog Programming for Artificial Intelligence/ Ivan Bratko, 4th edition, 2011 3. Expert Systems: Principles and Programming/ Joseph C. Giarratano and Gary Riley, 4th edition, 2005.
Supporting websites	
The physical environment for teaching	☐ √ Class room / ☐ labs / ☐ √ Virtual educational platform / ☐ Others
Necessary equipment and software	**YAP Prolog Compiler**
Supporting people with special needs	
For technical support	

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

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No.	Course learning outcomes	The associated program learning output code
Knowledge		
K1	Understanding the main concepts of knowledge-based systems and cognitive science	MK4
K2	Understanding the language of First-Order Logic	MK4
K3	Understanding the concept of expressing knowledge	MK4
K4	Understanding the concept of resolution	MK4
K 5	Understanding the concept of reasoning with horn clauses	MK4
K 6	Understanding the Prolog language	MK4
Skills		
S1	To represent knowledge and apply the concept of reasoning in problem solving based on knowledge base.	MS2
S2	To apply the syntax and semantic of First-Order Logic for representing objects and facts and to map atomic sentences into First-Order Logic.	MS2
S3	To use vocabulary, basic facts, and complex facts in expressing and representing knowledge using the First-Order Logic language.	MS2
S4	To apply propositional case, resolution derivations, and entailment procedure and to handle variables and quantifiers using resolution.	MS2
S5	To apply the concept of reasoning with horn clauses.	MS2
S6	To use the Prolog language syntax and semantic for answering questions and for developing knowledge based systems.	MS4
Competences		
C1	To apply the main concepts of cognitive and knowledge science for problems solving in real life.	MC1
C2	To build smart applications based on cognitive and knowledge science.	MC3
C3	To create knowledge based applications that match the requirements and needs of the labor market.	MC3

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	0	**0**	%20	0
Second / midterm exam	%30	**%30**	%20	30%
Participation / practical applications	0	**0**	10	30%
Asynchronous interactive activities	%30	**%30**	0	0
final exam	%40	**%40**	%50	40%

Science & IT	جامعـة الزيتونـة الأردنيـة	
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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. Introduction to Knowledge-based Systems** The Key Concepts: Knowledge, Representation, and Reasoning Why Knowledge Representation and Reasoning? Knowledge-Based Systems Why Knowledge Representation? Why Reasoning? The Role of Logic	Lectures	Textbook1 Pages: 1 - 14
2	**2. The Language of First-Order Logic** Introduction The Syntax The Semantics	Lectures	Textbook1 Pages: 15-22
3	**2. The Language of First-Order Logic (Continued)** The Pragmatics Explicit and Implicit Belief	Lectures	Textbook1 Pages:22-28
4	**3. Expressing Knowledge** Knowledge Engineering Vocabulary Basic Facts Complex Facts	Lectures	Textbook1 Pages: 31 - 34
5	**3. Expressing Knowledge (Continued)** Terminological Facts Entailments Abstract Individuals Other Sorts of Facts	Lectures	Textbook1 Pages: 34 - 45
6	**4. Resolution** The Propositional Case Handling Variables and Quantifiers	Lectures	Textbook1 Pages: 50-63
7	**5. Reasoning with Horn Clauses** Horn Clauses SLD Resolution	Lectures	Textbook1 Pages: 85 - 90
8	**5 Reasoning with Horn Clauses (Continued)** Computing SLD Derivations Backward Chaining Forward Chaining The First-Order Case	Lectures	Textbook1 Pages: 91 - 95
9	**1. The PROLOG Language** An example program: defining family relations Extending the example program by rules A recursive rule definition	Lectures	Supplementary reference 2 Pages: 3 - 19
10	**1. The PROLOG Language (Continued)** How Prolog answers questions Declarative and procedural meaning of programs	Lectures	Supplementary reference 2 Pages: 19 - 25

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11	**1. The PROLOG Language (Continued)** Selected review questions and exercises	Lectures	Supplementary reference 2 Pages: 14, 19, 24
12	**2. Syntax and Meaning of Prolog Programs** Data objects Matching Declarative meaning of Prolog programs	Lectures	Supplementary reference 2 Pages: 27 - 42
13	**2. Syntax and Meaning of Prolog Programs (Continued)** Procedural meaning Example: monkey and banana Order of clauses and goals	Lectures	Supplementary reference 2 Pages: 43 - 59
14	**2. Syntax and Meaning of Prolog Programs (Continued)** Remarks on the relation between Prolog and logic. Exercises	Lectures	Textbook1 Pages: 60-62
15	**Revision, Examples and Assignments Homework discussion**	Lectures	
16	**Final Exam**		

* 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	Homework 1 on chapter 1	1. Introduction to Knowledge-based Systems	Understanding the main concepts of knowledge-based systems and cognitive science
2	Homework 2 on chapter 2	2. The Language of First-Order Logic	Understanding the language of First-Order Logic
3	Homework 3 on chapter 2	2. The Language of First-Order Logic	Understanding the language of First-Order Logic
4	Homework 4 on chapter 3	3. Expressing Knowledge	Understanding the concept of expressing knowledge
5	Homework 5 on chapter 3	3. Expressing Knowledge	Understanding the concept of expressing knowledge
6	Homework 6 on chapter 4	4. Resolution	Understanding the concept of resolution
7	Homework 7 on chapter 5	5. Reasoning with Horn Clauses	Understanding the concept of reasoning with horn clauses
8	Homework 8 on chapter 5	5. Reasoning with Horn Clauses	Understanding the concept of reasoning with horn clauses
9	Homework 9 on the Supplementary reference 2	1. The PROLOG Language	Understanding the Prolog language
10	Homework 10 on the Supplementary reference 2	1. The PROLOG Language	Understanding the Prolog language
11	Homework 11 on the Supplementary reference 2	1. The PROLOG Language	Understanding the Prolog language
12	Homework 12 on the Supplementary reference 2	2. Syntax and Meaning of Prolog Programs	To use the Prolog language syntax and semantic for

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			answering questions and for developing knowledge based systems.
13	Homework 13 on the Supplementary reference 2	2. Syntax and Meaning of Prolog Programs	To use the Prolog language syntax and semantic for answering questions and for developing knowledge based systems.
14	Homework 14 on the Supplementary reference 2	2. Syntax and Meaning of Prolog Programs	To use the Prolog language syntax and semantic for answering questions and for developing knowledge based systems.
15	Revision, Examples and Assignments Homework discussion	Textbook1 + Supplementary reference 2	Understanding how to represent knowledge using the First-Order Logic and the Prolog languages
16	Final Exam		