



COLLEGE OF INFORMATION TECHNOLOGY
DEPARTMENT OF INFORMATION TECHNOLOGY
COURSE SYLLABUS/ SPECIFICATION

Course Code & Title: Artificial Intelligence/ ITCS 509

Weight: (3 - 0 - 3)

Prerequisite: NONE

NQF Level Allocated: Level 9

NQF Notional Hours / Credits: 120 notional hours/ 12 NQF credit

Description: This course focuses on solving real world problems using techniques and methods of Artificial Intelligence (AI) from a computer science perspective and familiarizes students with the present and future of AI. This course is to cover two types of problem solving approaches: search-based and knowledge-based. The course is also to explore advanced AI techniques, such as ANN, EC, and fuzzy logic.

Objective:

1. To understand a range of specialized theories, principles and concepts of Artificial Intelligence.
2. To critically explore various intelligent algorithms and techniques for solving complex real world problems.
3. To apply a range of specialist models and knowledge representation methods in developing intelligent systems.
4. To research on new trends in Artificial Intelligence.

SEMESTER:

INSTRUCTOR:

OFFICE TEL:

EMAIL:

Intended Learning Outcomes (ILOs):

A. Knowledge and Understanding		NQF Descriptor/ Level
A1	Concepts and Theories: <i>Demonstrate knowledge and critical understanding of core concepts and theories in artificial intelligence.</i>	Knowledge: theoretical understanding [Level 9]
A2	Contemporary Trends, Problems and Research: <i>Demonstrate critical awareness of the current problems, research issues and methods, technological advancements in field of artificial intelligence, such as machine learning, neural networks, expert systems.</i>	Knowledge: theoretical understanding [Level 9]
A3	Professional Responsibility: N/A	

B. Subject-specific Skills		NQF Descriptor/ Level
B1	Problem Solving: <i>Identify and solve problems using a range of specialized skills, techniques related to various artificial intelligence issues.</i>	Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical application [Level 9] Generic, Problem Solving and Analytical Skills [Level 9]
B2	Modeling and Design: Model, and design the components needed to implement intelligent systems such as expert systems, to meet desired needs within realistic constraints.	Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical application [Level 9]
B3	Application of Methods and Tools: Use and apply advanced techniques and tools (such as NLP, PROLOG, and A Network Language) to develop efficient artificially intelligent system.	Knowledge: Practical application [Level 9] Communication, ICT and Numeracy Skills [Level 9]

C. Critical-Thinking Skills		NQF Descriptor/ Level
C1	Analytic skills: Critically evaluate and test employed AI techniques in given problems and test the performance of the resulting intelligent system.	Generic Problem Solving & Analytical skills [Level 9]
C2	Synthetic: <i>Integrate individual software components with other components such as a Neural Network classifier in order to create a larger AI system with more capabilities.</i>	Generic, Problem Solving and Analytical Skills [Level 9]
C3	Creative Thinking and innovation: N/A	

D. General and Transferable Skills (other skills relevant to employability and personal development)		NQF Descriptor/ Level
D1	Communication: Convey ideas and describe results rigorously using logic, theoretical models and formal languages, and present these in appropriate written and oral forms.	Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical application [Level 9]
D2	Teamwork and Leadership: <i>Work effectively as a member/leader of a team in order to complete a pre-defined research project.</i>	Competence: Autonomy, Responsibility and Context [Level 8]
D3	Organizational and Developmental Skills: N/A	
D4	Ethics and Social Responsibility: N/A	

Course Structure (Outline)

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Week	Hours		ILOs	Topics	Teaching Method	Assessment Method
	Lec.	Lab				
1	3	-	A1	Introduction and Intelligent Agents: AI and Intelligent Agent concepts	Lecture/ Class Discussion	Major Exam (9th week) and Final Exam (Last Week)

2	3	-	A1, D1	Problem Solving: Problem definition and formulation, Problem Solving Agents.	Lecture/ Exercises	Major Exam (9th week) and Final Exam (Last Week)
3-5	9	-	A1,B1,B2,C1	Search-based Problem solving: Search Space Graph and Tree, Uniformed search strategies, Informed search strategies, Best first search: Greedy and A* search, optimization problems (Hill climbing search, Simulated annealing search, Genetic algorithms)	Lecture/ In-class Exercises/ Independent Learning	Exercises (B1,C1) /Research Assignment 1 (A1, B1, B2, C1)/ Major Exam (9th week) and Final Exam (Last Week)
6	3	-	A1 ,B2, B3, C1	Knowledge-Based Problem Solving: Concepts, Knowledge Representation: Propositional logic, First order logic (Syntax and semantic), Production rules, Semantic Network, Frames and objects.	Lecture/ Software Demo/ Demo/	Major Exam (9th week) and Final Exam (Last Week)
7	3	-	A1, B2, C1	Knowledge and Reasoning: Inference Engines, Forward and Backward Chaining, Reasoning Patterns in propositional Logic.	Lecture/ In-class Exercises	Exercises (B2, C1)/ Major Exam (9th week) and Final Exam (Last Week)
8	3	-	A1,B1,B2	Knowledge Based Systems: Concepts and Development, Expert Systems.	Lecture/ Discussion	Major Exam (9th week) and Final Exam (Last Week)

9	3	-	A1,B1,B2, C1,C2	Machine Learning: Learning from observation, Forms of learning, Inductive learning, Learning decision trees	Lecture/ Discussion	Major Exam (9th week) and Final Exam (Last Week)
10-11	6	-	A2,B1, B2, B3,C1,C2	Neural Network: Concepts, Types of neural network architecture, forward and backward propagation algorithm.	Lecture/ Independent Learning/ In-class Exercises	Exercises (B2, C1)/ Final Exam (Last Week)
12	3	-	A2,B1, B2, B3,C1,C2,	Natural Language Processing: Steps in Processing Natural Language, Syntax, Examples of NLP applications.	Lecture/ Discussion	Final Exam (Last Week)
13	3	-	A2,B1,B2,C1,C2	Evolutionary Computation: Algorithms and applications	Lecture/ In-class Exercises/ Independent learning	Research Assignment 2(A2,B1, B2, C1, C2)/ Final Exam (Last Week)
14	3	-	A2, B1,B2	Fuzzy Logic	Lecture/ Discussion/ In-class Exercises	Final Exam (Last Week)
15	3	-	A1,A2,B1,B2,B3,C1,C2,D1, D2	Students team research projects (reports and presentations)	Student presentations of research projects	Evaluation of Research Project Outcome & Presentation (A1,A2,B1, B2,B3,C1,C2,D1, D2)
16	2					Final Exam (A1,A2,B1, B2,B3,C1,C2)

Teaching Materials:

Textbook(s):	<ol style="list-style-type: none"> 1. Stuart Russell and Peter Norvig, <i>Artificial Intelligence: A Modern Approach</i>, Prentice Hall, 4th edition, 2020. 2. Neapolitan, Richard E., and Xia Jiang. <i>Artificial Intelligence: With an Introduction to Machine Learning</i>. 2nd Ed., CRC Press, 2018.
Handout(s):	PowerPoint slides available on Moodle i.e. http://www.ahlia.edu.bh/moodle
Reference(s):	<ol style="list-style-type: none"> 1. Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016. 2. Freedle R. Artificial intelligence and the future of testing. Psychology Press; 2014 Feb 24. 2018 3. Kevin P. Murphy, <i>Machine Learning: A Probabilistic Perspective</i>, The MIT Press, 2012. 4. Charniak, E., Riesbeck, C., McDermott, D., Meehan, J. Artificial Intelligence Programming. New York: Psychology Press. 2nd edition. 2014. 5. K.-L. Du and M. N. S. Swamy, <i>Neural Networks and Statistical Learning</i>, Springer, 2013. 6. Slade, Stephen. Artificial Intelligence Applications on Wall Street. Routledge, 2017. 7. C. M. Bishop, <i>Pattern Recognition and Machine Learning</i>, Springer, 2011. 8. Association for Advancement of Artificial Intelligence (AAAI) Website: http://www.aaai.org/home.html <p>More references are available in the course website in Moodle.</p>

Assessment

Type of Assessment ¹	Description ²	ILOs ³	Weighting
Research Assignment 1	The assignment consists of problem-solving based questions regarding topics in AI covered during the first 5 weeks. The purpose of the assignment is to assess students individually where they have to demonstrate their extensive and detailed knowledge and critical understanding of key concepts, theories, methods, tools and techniques of AI. The assignment will also assess students' skills to solve and analyze AI problems using advanced techniques, methods and tools. Soft copy submission is required by the end of the 6 th week through the course page in Moodle where answers will be checked by Turnitin against	A1, B1, B2, C1	20%

	plagiarism. Best one out of the two research assignment will be considered.		
Research Assignment 2	Similar to assignment 1 but topics will cover the new trends and advanced techniques. Soft copy submission is required by the end of the 12 th week through the course page in Moodle where answers will be checked by Turnitin against plagiarism. Best one out of the two research assignment will be considered.	A2,B1, B2, C1, C2	
Exercises	In-class exercises consist of problem solving and application of different tools. Each exercise will be one hour duration.	B1,B2,C1	Formative Assessment
Midterm Exam	The midterm exam will be an in-class 1-hour exam that will consist of short-answer, essay, and problem solving questions and cover the topics studied in the first 8 weeks.	A1,B1, B2, C1	20%
Team Research Project Report and Presentation	Starting from weak 4, the class will be divided into teams of 4-5 students and each will be asked to study a research problem in AI and machine learning utilizing the skills and tools learned in class. Teams are required to plan and execute the research project that may involve the application of advanced techniques and tools to develop efficient artificially intelligent system. In the final week, each team will have to submit their research report (worth 14%) explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation (worth 6%) summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor.	A1,A2,B1, B2,B3,C1, C2,D1, D2	20%
Final Exam	The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions in AI and machine learning.	A1,A2,B1, B2,B3,C1, C2	40%
Overall			100%

Admissions	
Pre-requisites	NONE
Minimum number of students	4
Maximum number of students	25

Ahlia University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.ahlia.edu.bh/integrity for more information).