Course Specification of Advanced Artificial Intelligence

I. Course Identification and General Information

1.	Course Title:	Advanced Artificial Intelligence				
2.	Course Code &Number:	CCE429				
3.	Credit hours:	**C.H**				**Total**
		Th.	Tu.	Pr.	Tr.	
		2	-	2	-	3
4.	Study level/ semester at which this course is offered:	5th Level/1st Semester				
5.	Pre –requisite (if any):	Artificial Intelligence (CCE326)				
6.	Co –requisite (if any):	None.				
7.	Program (s) in which the course is offered:	B.Sc. of Computer and Control Engineering				
8.	Language of teaching the course:	Arabic & English				
9.	Location of teaching the course:	Class Room (Faculty of Engineering)				
10.	Prepared By:	Prof. Abdul Raqib Abdo Asaad				
11.	Date of Approval					

II. Course Description

This course aims to provide students with advanced concepts & methods related to the field of Artificial Intelligence (AI) such as, feature extraction & classifications, machine learning and deep learning techniques. These modern techniques play as the main parts/challenges to many rises demands applications like expert systems and Intelligent robotics applied to social, marketing and industrial environments. Course topics include learning, natural language processing, augmented grammars and semantic interpretation, uncertain knowledge and reasoning, deep learning machines, and expert systems. Throughout theoretical lectures and computer-based lab works, students develop problem-solving skills related to intelligent & expert systems and their applications in industrials.

III. Course Intended learning outcomes (CILOs) of the course

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a1	Define advanced topics and techniques related to AI.	A1, A3

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Prof. Dr. Abdul Raqib Abdo Asaad	Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad

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a2	Recognize the importance and principles of learning methods, natural language processing, and expert systems	A2
b1	Identify some specific techniques that can be exploited in constructing expert and intelligent AI systems.	B1, B3
b2	Solve expert level problems related to the field of computer engineering and control, considering computational constraint.	B1, B4
c1	Use modern AI software and programming languages to the development of expert and/or intelligent AI systems for industrial and control applications.	C4
c2	Build AI programs that process spoken languages, written texts, and images data.	C1, C2
d1	Function effectively as an individual or as a member in a team to achieve course's project and/or during laboratory activities.	D1
d2	Prepare sound reports and presentations by following the standards research technology.	D4

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1 Define advanced topics and techniques related to AI.	▪ Active Lectures ▪ Interactive Class discussion ▪ Laboratory Works ▪ Use of Information Technology Tools	▪ Written Test and Quizzes ▪ Reports evaluation ▪ Presentations evaluation
a2 Recognize the importance and principles of learning methods, natural language processing, and expert systems		

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1 Identify some specific techniques that can be exploited	▪ Active Lectures	

	in constructing expert and intelligent AI systems.	▪ Interactive Class discussion	▪ Written Test and Quizzes
b2	Solve expert level problems related to the field of computer engineering and control, considering computational constraint.	▪ Laboratory Works ▪ Homework & Assignments ▪ Project	▪ Reports evaluation ▪ Presentations evaluation

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies

Course Intended Learning Outcomes		Teaching strategies	Assessment Strategies
c1	Use modern AI software and programming languages to the development of expert and/or intelligent AI systems for industrial and control applications.	▪ Active Lectures ▪ Laboratory Works ▪ Homework & Assignments ▪ Project	▪ Written Test and Quizzes ▪ Reports evaluation ▪ Presentations evaluation
c2	Build AI programs that process spoken languages, written texts, and images data.		

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies

Course Intended Learning Outcomes		Teaching strategies	Assessment Strategies
d1	Function effectively as an individual or as a member in a team to achieve course's project and/or during laboratory activities.	▪ Laboratory Works ▪ Project	▪ Observation ▪ Reports evaluation ▪ Presentations evaluation
d2	Prepare sound reports and presentations by following the standards research technology.	▪ Use of Information and Technology Tools ▪ Project	▪ Reports evaluation ▪ Presentations evaluation

IV. Course Content

A – Theoretical Aspect

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Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Course Introduction and Learning	a1, a2, b1, b2	• Introduction to learning, classifications, and Deep Learning techniques and Tools, • Learning form examples • Knowledge in learning • Learning probabilistic modes • Reinforcement learning	2	4
2.	Natural Language Processing	a1, a2, b1, b2	• Language mode • Test classification • Information retrieval • Information extraction	2	4
3.	Natural Language for Communication	a1, a2, b1, b2	• Phrase structure grammars • Syntactic analysis (parsing) • Augmented grammars and semantic interpretation • Machine translation • Speech recognition	3	6
4.	Uncertain Knowledge and Reasoning	a1, b1, b2	• Quantifying uncertainty • Probabilistic reasoning • Probabilistic reasoning over time • Making decision	1.5	3
5.	Deep Learning Machines (Single NN, Multi-NN, Conv-NN)	a1, a2, b1, b2, c2	• Introduction to machine learning, definition, classifications and techniques, • Single Neuron Network machines, • Multi-Neuron Networks and Conventional Neuron Networks (CNN), • Deep Learning API and Frameworks such as Alex Net, Le-Net,…etc.	3	6
6.	Expert Systems	a1, a2, b1, b2, c2	• Representing and using domain knowledge • Expert system shells	2.5	5

			• Explanation		
			• Knowledge acquisition		
Number of Weeks /and Units Per Semester				**16**	**32**

B - Practical Aspect

Order	Topics List	Number of Weeks	Contact hours	Learning Outcomes
Using AI with Python (or any AI programming language) in the following topics:				
1.	Supervised learning (Classification, Regression)	2	4	a1, a2, b1, b2, c1, d1
2.	Unsupervised learning (Clustering)	1	2	a1, a2, b1, b2, c1, d1
3.	Neural Networks and Genetic Algorithms	3	6	a1, a2, b1, b2, c1, d1
4.	Reinforcement learning	1	2	a1, a2, b1, b2, c1, d1
5.	Deep learning	1	2	a1, a2, b1, b2, c1, d1
6.	Natural language processing	1	2	a1, a2, b1, b2, c1, c2, d1
7.	Speech recognition	1	2	a1, a2, b1, b2, c1, c2, d1
8.	Computer vision	1	2	a1, a2, b1, b2, c1, c2, d1
9.	Review	1	2	a1, a2, b1, b2, c1, c2, d1, d2
10.	AI Projects Presentations and Evaluations	2	4	a1, a2, b1, b2, c1, c2, d1, d2
Number of Weeks /and Units Per Semester		**14**	**28**	

V. Teaching strategies of the course

- Active Lectures
- Interactive Class discussion
- Laboratory Works
- Project
- Use of Information Technology Tools.
- Homework & Assignments.

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VI. Reports & Reports

No	Assignments	Aligned CILOs	Week Due	Mark
1.	Learning and Natural Language Processing and Communications	a1, a2, b1, b2, c2, d1	3rd to 7th	2
2.	Deep Learning & Expert Systems Research reports on Learning, classifications, prediction, and Deep Learning Machines Search Web for some problem solving based on Deep learning & Expert Systems	a1, a2, b1, b2, c2, d1, d2	9th to 14th	6
3.	Laboratory Reports	a1, a2, b1, b2, c1, c2, d2	2nd to 11th	7
	Total			**15**

VII. Schedule of Assessment Tasks for Students during the Semester

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Assignments & Reports	3rd to 14th	15	10%	a1, a2, b1, b2, c1, c2, d2
2.	Quizzes	5th, 10th & 14th	7.5	5%	a1, a2, b1, b2
3.	Midterm Exam (Theory)	8th	18.75	12.5%	a1, a2, b1, b2
4.	Final Lab. Exam (including Course Project Evaluation)	13th, 14th & 15th	33.75	22.5%	a1, a2, b1, b2, c1, c2, d1, d2
5.	Final Exam (Theory)	16th	75	50%	a1, a2, b1, b2, c2
	Total		**150**	**100%**	

VIII. Learning Resources

Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two)

	1- Stuart Russell and Peter Norvig (2009), "Artificial Intelligence: A Modern Approach", Third Edition,

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	2- Pearson.Prateeck Joshi -2017- Artificial Intelligence with Python- 1st Ed.- Packt Publishing Ltd. ISBN 978-1-78646-439-2.
2- Essential References	
	1- Zsolt Nagy (2018), "Artificial Intelligence and Machine Learning Fundamentals", Packt Publishing, ISBN 978-1-78980-165-1.
	2- Elaine Rich and Kevin Knight (2010), "Artificial Intelligence", Third Edition, McGraw-Hill.
	3- Winston (1992), "Artificial Intelligence", Third Edition, Pearson.
	4- George F. Luger (2008), "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Sixth Edition, Pearson.
3- Electronic Materials and Web Sites etc.	
	1- www.packtpub.com
	2- www.packtpub.com/mapT

IX. Course Policies:

1.	**Class Attendance:** -A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic
2.	**Tardy:** - For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.
3.	**Exam Attendance/Punctuality:** - A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.
4.	**Assignments & Projects:** - The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5.	**Cheating:** - For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.

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6.	**Plagiarism**: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7.	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. Lecture notes and assignments my given directly to students using soft or hard copy

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Assoc. Prof. Dr. Farouk Al-Fuhaidy**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

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Course Plan (Syllabus) of Advanced Artificial Intelligence

I. Information about Faculty Member Responsible for the Course								
Name of Faculty Member	Prof. Dr. Abdul Raqib Abdo Asaad	**Office Hours**						
Location& Telephone No.		**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**	
E-mail								

II. Course Identification and General Information						
1-	Course Title:	Advanced Artificial Intelligence				
2-	Course Number & Code:	CCE429				
3-	Credit hours:	**C.H**				Total
		Th.	Tu.	Pr.	Tr.	
		2	-	2	-	3
4-	Study level/year at which this course is offered:	5th Level/1st Semester				
5-	Pre –requisite (if any):	Artificial Intelligence (CCE326)				
6-	Co –requisite (if any):	None.				
7-	Program (s) in which the course is offered	B.Sc. of Computer and Control Engineering				
8-	Language of teaching the course:	Arabic & English				
9-	System of Study:	Semesters				
10-	Mode of delivery:	Collective and individual learning				
11-	Location of teaching the course:	Class Room (Faculty of Engineering)				

III. Course Description

This course aims to provide students with advanced concepts & methods related to the field of Artificial Intelligence (AI) such as, feature extraction & classifications, machine learning and deep learning techniques. These modern techniques play as the main parts/challenges to many rises demands applications like expert systems and Intelligent robotics applied to social, marketing and industrial environments. Course topics include learning, natural language processing, augmented

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grammars and semantic interpretation, uncertain knowledge and reasoning, deep learning machines, and expert systems. Throughout theoretical lectures and computer-based lab works, students develop problem-solving skills related to intelligent & expert systems and their applications in industrials.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:

1- Define advanced topics and techniques related to AI.

2- Recognize the importance and principles of learning methods, natural language processing, and expert systems

3- Identify some specific techniques that can be exploited in constructing expert and intelligent AI systems.

4- Solve expert level problems related to the field of computer engineering and control, considering computational constraint.

5- Use modern AI software and programming languages to the development of expert and/or intelligent AI systems for industrial and control applications.

6- Build AI programs that process spoken languages, written texts, and images data.

7- Function effectively as an individual or as a member in a team to achieve course's project and/or during laboratory activities.

8- Prepare sound reports and presentations by following the standards research technology.

V. Course Content:

- Distribution of Semester Weekly Plan of Course Topics/Items and Activities

A – Theoretical Aspect:

Order	Topics List	Sub Topics List	Week Due	Contact Hours
1.	Course Introduction & The Learning	• Introduction to learning, classifications, and Deep Learning techniques and Tools, • Learning form examples • Knowledge in learning • Learning probabilistic modes	1st, 2nd	4

		• Reinforcement learning		
2.	Natural Language Processing	• Language mode • Test classification • Information retrieval • Information extraction	3rd, 4th	4
3.	Natural Language for Communication	• Phrase structure grammars • Syntactic analysis (parsing) • Augmented grammars and semantic interpretation • Machine translation • Speech recognition	5th, 6th, 7th	6
4.	Midterm Exam	• All previous topics	8th	2
5.	Uncertain Knowledge and Reasoning	• Quantifying uncertainty • Probabilistic reasoning • Probabilistic reasoning over time • Making decision	9th, 10th	3
6.	Deep Learning Machines (Single NN, Multi-NN, Conv-NN)	• Introduction to machine learning, definition, classifications and techniques, • Single Neuron Network machines, • Multi-Neuron Networks and Conventional Neuron Networks (CNN), • Deep Learning API and Frameworks such as Alex Net, Le-Net,…etc.	10th to 13th	6
7.	Expert Systems	• Representing and using domain knowledge • Expert system shells • Explanation • Knowledge acquisition	13th to 15th	5
8.	Final Exam	• All topics	16th	2
Number of Weeks /and Units Per Semester			**16**	**32**

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B - Practical Aspect

Order	Topics List	Number of Weeks	Contact hours
	Using AI with Python (or any AI programming language) in the following topics:		
1.	Supervised learning (Classification, Regression)	1st, 2nd	4
2.	Unsupervised learning (Clustering)	3rd	2
3.	Neural Networks and Genetic Algorithms	4th, 5th, 6th	6
4.	Reinforcement learning	7th	2
5.	Deep learning	8th	2
6.	Natural language processing	9th	2
7.	Speech recognition	10th	2
8.	Computer vision	11th	2
9.	Review	12th	2
10.	AI Projects Presentations & Evaluations	13th, 14th	4
11.	Final Lab. Exam	15th	2
Number of Weeks /and Units Per Semester		15th	28

VI. Teaching strategies of the course:

- Active Lectures
- Interactive Class discussion
- Laboratory Works
- Project
- Use of Information Technology Tools.
- Homework & Assignments.

VII. Assignments & Report :

No.	Assignments	Week Due	Mark
1.	Learning and Natural Language Processing and Communications	3rd to 7th	2.5
2.	Deep Learning & Expert Systems	9th to 15th	7.5

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	Research reports on Learning, classifications, prediction, and Deep Learning Machines		
3.	Laboratory Reports	2nd to 11th	7
	Total		**15**

VIII. Schedule of Assessment Tasks for Students during the Semester:				
No.	**Type of Assessment Tasks**	**Week Due**	**Mark**	**Proportion of Final Assessment**
1.	Assignments & Reports	3rd to 14th	15	10%
2.	Quizzes	5th, 10th & 14th	7.5	5%
3.	Midterm Exam (Theory)	8th	18.75	12.5%
4.	Final Lab. Exam (including Course Project Evaluation)	13th, 14th & 15th	33.75	22.5%
5.	Final Exam (Theory)	16th	75	50%
6.	Assignments & Reports	3rd to 14th	15	10%
Total			**150**	**100%**

IX. Learning Resources:

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2- Essential References

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4- George F. Luger (2008), "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Sixth Edition, Pearson.

3- Electronic Materials and Web Sites *etc*.

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