University of Asia Pacific (UAP)
Department of CSE

CSE 403 Course Outline

Program: Bachelor of Science in CSE

Course Title: Artificial Intelligence and Expert Systems

Course Code: **CSE 403**

Semester: **Spring 22**

Level: 4th year, 1st Semester (4-1)

Credit Hour: **3.0**

Name & Designation of Teacher: Dr. Nasima Begum (DNB), Associate Professor

Office/Room: 7th Floor, Teacher's Compound

Class Hours: **Sec A:** Sunday (3:30 – 4:50) PM (R: 702), Thursday (12:30 – 1:50) PM (R: 713)

Sec B: Sunday (2:00 – 3:20) PM (R: 714), Tuesday (12:30 – 1:50) PM (R: 714)

Consultation Hours: **Sec A:** Tuesday (11:00 – 12:20), **Sec B:** Tuesday (2:00 – 3:20) PM

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Rationale: Required course to Pattern Recognition in the CSE program. This knowledge is very important for the field of Pattern Recognition and Machine Learning professional.

Pre-requisite (if any)**:** **CSE 205, CSE 207**

Course Synopsis: Introduction, Definition, Foundation, **Agent:** Characteristics, Environments, Agent Types, **First Order Logic:** Basic Elements, Quantifiers, Proof Tree, Forward Chaining, Backward Chaining, Resolution, **Searching: Uninformed Search:** Breadth-First Search (BFS), Depth-First Search (DFS), Uniform-Cost Search (UCS), Depth-Limited Search (DLS), Iterative Deepening Search (IDS), Bi-Directional Search (BDS), **Informed Search:** Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search, **Local Search:** Hill-Climbing Search, Simulated Annealing, Local Beam Search, Genetic Algorithm, **Game Playing:** Game Definition, Game Theory, Zero Sum Game, Minimax Algorithm, AlphaBeta Pruning, **Planning and Acting:** Action Schema, Preconditions and Effects, PDDL Description, **Uncertainty and Reasoning:** Rational Decision, Probability Theory, Utility Theory, Decision Theory, Bayes' Rule, **Decision Making:** Axioms of Utility Theory, Allais Paradox, Ellsberg Paradox, **Learning:** Factors, Components, Types, Unsupervised Learning, Supervised Learning, Semi-supervised Learning, Deductive Learning, Inductive Learning, Reinforcement Learning.

Course Objectives: The objectives of this course are to:

1. Provide the fundamental knowledge of AI, history, success, achievement, inference, intelligent agent, types of agent, expert system, knowledge representation technique and analyze them in various practical scenarios.
2. Explain various AI search techniques and game theory for different real life problems.
3. Demonstrate different probabilistic reasoning technique for various cases.
4. Explain different advanced AI topics (Artificial Neural Network (ANN), and different learning technique (supervised, unsupervised, reinforcement) to build AI agents.

Course Outcomes (CO) and their mapping with Program outcomes (PO) and Teaching-Learning Assessment methods:

CO No.	**CO Statements:** Upon successful completion of the course, students should be able to:	**Corresponding POs (Appendix-1)**	**Bloom's taxonomy domain/level (Appendix-2)**	**Delivery methods and activities**	**Assessment Tools**
CO1	**Understand** the fundamental concepts of AI and Intelligent Agent in various practical scenarios.	2	1/Understand	Lecture, Multimedia, Problem solving	Quiz, Problem solving, Written exam, Mid Exam
CO2	**Analyze** various AI search techniques and Game Theory for different real life problems.	4	1/Analyze	Lecture, Multimedia, Problem Solving,	Quiz, Presentation Mid Exam
CO3	**Apply** different knowledge representation & reasoning (KRR) techniques and Fuzzy Logic in different scenarios.	1	1/Apply	Lecture, Multimedia, Group Discussion, Problem solving	Assignment, Problem solving, Final Exam
CO4	**Interpret** Markov Model, Bayesian Rule in uncertainty and probabilistic reasoning.	3	1/Analyze	Lecture, Problem Solving, Group discussion	Assignment, Problem solving, Final Exam
CO5	**Design** and **implement** AI agents based on ANN and different types of Learning techniques.	3	1/Evaluate	Lecture, Multimedia, Problem solving	Case study, assignment, project

Weighting COs with Assessment Methods:

Assessment Type		Marks Distribution	CO1	CO2	CO3	CO4	CO5
Final Exam (50%)	**Written Exam**	**50**		20	10	10	10
Mid Term (20%)	**Written Exam**	**20**	8.33	11.67			
Assessment (30%)	**Assignment/Viva /Presentation**	**10**			5		5
	Quiz	**20**	10	10			
Total		**100**	18.33	41.67	15	10	15

Course Content Outline and mapping with Cos

Weeks	Topics / Content	Course Outcome	Delivery Methods and Activities	Reading Materials
1	Introduction to AI	CO1	Lecture, multimedia	AIMA: ch 1, Lecture Slides
2	Intelligent Agent	CO1	Lecture, multimedia, Group discussion	AIMA: ch 2, Lecture Slides
CT-1				
3	Uninformed Search (BFS, DFS, UCS, IDS)	CO2	Lecture, multimedia, Case Study	AIMA: ch 3, Lecture Slides
4-5	Informed Search (Best-First, Greedy Best-First, A*, Heuristics)	CO2	Lecture, multimedia, Case Study	AIMA: ch 3, Lecture Slides
CT-2				
6	Local Search, Genetic Algorithm	CO2	Lecture, multimedia,, Problem Solving	AIMA: ch 4, Lecture Slides
6-7	Adversarial Search, Game Theory	CO2	Lecture, multimedia, Case Study	AIMA: ch 5, Lecture Slides
CT-3				
Mid Term Exam				
8-9	KRR, Fuzzy Logic	CO3	Lecture, multimedia	AIMA: ch 7-8, Lecture Slides
10-11	Understand probabilistic reasoning,	CO4	Lecture, multimedia, Problem Solving	AIMA: ch 13-14, Lecture Slides

	Interpret Bayesian Rule, basics of Markov Model			
CT-4				
12	Intro to Artificial Neural Networks and different Learning Techniques	CO5	Lecture, multimedia, Case Study	AIMA: ch 18, Lecture Slides
13	Intro to multilayer Neural Networks and different problems	CO5	Lecture, multimedia, problem solving	AIMA: ch 18, Lecture Slides
14	Presentation , Review	CO1-CO5	Lectures, multimedia	AIMA all ch, Lecture Slides
Final Exam				

Minimum attendance: 70% class attendance is mandatory for a student in order to appear at the final examination.

Textbook: AIMA = Artificial Intelligence: A Modern Approach-by Stuart Russell and Peter Norving (3rd / 4th Edition)

Recommended References: Artificial Intelligence-by Patrick Henry Winston (3rd Edition)

Other References: http://ai.berkeley.edu/lecture_slides.html

Grading System: As per the approved grading scale of University of Asia Pacific (Appendix-3).

Special Instructions: **Late attendance:** Students who will enter the class after the attendance call will be marked as absent.

Assignment: Assignment (Written and/or presentation.) will be given throughout the semester. **Copied** assignments will be graded as zero. Late submission will result in a 50% deduction in score.

Class Test: There will be no make-up quizzes. 3 out of 4 class tests will be considered. **CT1, best of CT2 & CT3, a**nd **CT4 will be considered**.

Student's responsibilities: Students must come to the class prepared for the course material covered in the previous class (es). They must submit their assignments on time.

Prepared by	Checked by	Approved by
Dr. Nasima Begum	Chairman, PSAC committee	Head of the Department

Appendix-1:

Washington Accord Program Outcomes (PO) for engineering programs:

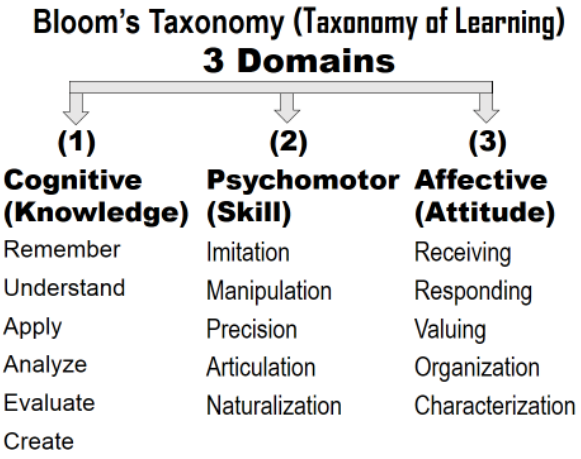
No.	PO	Differentiating Characteristic
1	Engineering Knowledge	Breadth and depth of education and type of knowledge, both theoretical and practical
2	Problem Analysis	Complexity of analysis
3	Design/ development of solutions	Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified
4	Investigation	Breadth and depth of investigation and experimentation
5	Modern Tool Usage	Level of understanding of the appropriateness of the tool
6	The Engineer and Society	Level of knowledge and responsibility
7	Environment and Sustainability	Type of solutions.
8	Ethics	Understanding and level of practice
9	Individual and Team work	Role in and diversity of team
10	Communication	Level of communication according to type of activities performed
11	Project Management and Finance	Level of management required for differing types of activity
12	Lifelong learning	Preparation for and depth of Continuing learning.

Generic Skills (Detailed):

PO	Details
1. **Engineering Knowledge (T)**	Apply knowledge of mathematics, sciences, engineering fundamentals and manufacturing engineering to the solution of complex engineering problems.
2. **Problem Analysis (T)**	Identify, formulate, research relevant literature and analyze complex engineering problems, and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions (A)**	Design solutions, exhibiting innovativeness, for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, economical, ethical, environmental and sustainability issues.
4. **Investigation (D)**	Conduct investigation into complex problems, displaying creativeness, using research-based knowledge, and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
5. **Modern Tool Usage (A & D)**	Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
6. **The Engineer and Society (ESSE)**	Apply reasoning based on contextual knowledge to assess societal, health, safety, legal, cultural, contemporary issues, and the consequent responsibilities relevant to professional engineering practices.
7. **Environment and Sustainability (ESSE)**	Understand the impact of professional engineering solutions in societal, global, and environmental contexts and demonstrate knowledge of and need for sustainable development.

8. **Ethics (ESSE)**	Apply professional ethics with Islamic values and commit to responsibilities and norms of professional engineering code of practices.
9. **Communication (S)**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
10.**Individual and Team Work (S)**	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
11. **Life Long Learning (S)**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
12. **Project Management and Finance (S)**	Demonstrate knowledge and understanding of engineering management and financial principles and apply these to one's own work, as a member and/or leader in a team, to manage projects in multidisciplinary settings, and identify opportunities of entrepreneurship.

Appendix-2



Appendix-3

UAP Grading Policy:

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00