AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)
Faculty of Science and Technology (FST)
Department of Computer Science (CS)
Undergraduate Program

COURSE PLAN SEMESTER: **Fall 2023-2024**

I. Course Core and Title

CSC4226: Artificial Intelligence and Expert System

II. Credit

3 credit hours (3 hours of Lab & 2 hour theory per week)

III. Nature

Core Course for CS, CSE, CSSE, SE, CIS

IV. Prerequisite

CSC2211: Algorithms

V. Vision:
Our vision is to be the preeminent Department of Computer Science through creating recognized professionals who will provide innovative solutions by leveraging contemporary research methods and development techniques of computing that is in line with the national and global context.

VI. Mission:
The mission of the Department of Computer Science of AIUB is to educate students in a student-centric dynamic learning environment; to provide advanced facilities for conducting innovative research and development to meet the challenges of the modern era of computing, and to motivate them towards a life-long learning process.

VII - Course Description:

- Analyze four different types of intelligent agents and their environment.
- Explain and compare different searching techniques using BFS, DFS, UCS, DLS, and IDS.
- Illustrate informed search and exploration methods like A* and Hill Climbing.
- Explain Constraint satisfaction problems and search techniques in game playing.
- Analyze Logic representation in propositional and first-order logic.
- Explain Genetic Algorithm for problem solving.
- Illustrate Neural Network notations and architectures and solve problems using perception learning rules.
- Explain Expert System for problem solving.

VIII – Course outcomes (CO) Matrix:

By the end of this course, students should be able to:

COs*	CO Description	Level of Domain**				PO Assessed***
		C	P	A	S	
CO1	**Explain** various concepts from Artificial Intelligence and Expert System research domain using various complex problems considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.			3		PO-f-1
CO2	**Understand** artificial intelligence and its related terms to gain the basic ideas of artificial intelligence so that students will be able to know about the metrics related to performance which will help them to differentiate between different types of Expert systems.			3		PO-f-1
CO3 **	**Apply** different Artificial Intelligence techniques such as search algorithms, genetic algorithm, CSP and uncertainty etc. to solve different real-life problems.			3		PO-f-1
CO4 **	**Analysis and design** of different AI techniques to provide valid conclusions in real life problem solving.	5				PO-f-2

C: Cognitive; P: Psychomotor; A: Affective Domain

* *CO assessment method and rubric of COs assessment is provided in later section*
** *COs will be mapped with the Program Outcomes (POs) for PO attainment*
*** *The numbers under the 'Level of Domain' columns represent the level of Bloom's Taxonomy each CO corresponds to.*
**** *The numbers under 'PO Assessed' column represent the POs each CO corresponds to.*

IX – Topics to be covered in Theory class*:

Time Frame	CO Mapped	- Topics	Teaching Activities	Assessment Strategy(s)
Week 1	CO1, CO2	Introduction to AI: Definition of AI, Approaches of AI, Turing Test Foundation of AI. Intelligent Agent: Agent and Environment, Types of Agents Learning agent Concept of Rationality, Components of Agent Program.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 2	CO1, CO2	Intelligent Agent: Agent and Environment, Types of Agents Learning agent Concept of Rationality, Components of Agent Program.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 3	CO1, CO2	Uninformed Search: Problem-solving agent, Formulating problems, Example problems, Search strategies: BFS, Uniform Cost Search, DFS, Depth-limited search, Iterative deepening search, Bi-directional search.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 4	CO1, CO2	Informed Search: Best first search, Greedy search, A* search, Heuristic functions, IDA* search, Iterative improvement algorithms, Hill-climbing Search, Simulated Annealing	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 5	CO3	Adversarial search: Games, Optimal decisions in games, optimal strategies, the min-max algorithm, optimal decisions in multiplayer games	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 6	CO3	Alpha-beta pruning, Imperfect decisions, Evaluation functions, cutting off search, Games including elements of chance.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 7	CO1, CO2	Genetic Algorithm: Biological Background, Basic Outline, Encoding system, Crossover, Mutation, Selection. Solving Example Problems using GA	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Midterm (Week 8)				
Week 9	CO3, CO4	Constraint Satisfaction Problems: Backtracking search for CSPs, Variable	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam

		and value ordering, propagating information through constraints, Intelligent backtracking.		
Week 10	CO3, CO4	Statistical Reasoning: Probability, Bayes Theorem	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 11	CO3, CO4	Bayes Network, Application of Bayes Theorem, Hidden Markov Model(HMM)	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 12	CO3, CO4	Introduction to Artificial Neural Networks: Objectives, History, Applications and Biological Inspiration of Artificial Neural Networks	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 13	CO3, CO4	Backpropagation Algorithm, Learning using Backpropagation	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 14 .	CO3, CO4	Knowledge & Reasoning: Representing Knowledge using Logic. Propositional vs. First-order Logic, Inference, Advantages of First-order Logic, Application of First-order Logic.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 15	CO3, CO4	Expert System: Introduction, Architecture, Participants, and Components of Expert System. Review, Discussion, Open problems, and Brainstorming	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Final term (Week 16)				

* The faculty reserves the right to change, amend, add or delete any of the contents.

X – Mapping of PO/PLO and K, P, A of this course:

PO Indicator ID	PO Indicators Definition (As per the requirement of WKs)	Domain	K	P	A
PO-f-1	Apply information and concepts in natural science with the familiarity of issues.	Affective Level 3 (Valuing)			
PO-f-1	Apply information and concepts of mathematics with the familiarity of issues.	Affective Level 3 (Valuing)			
PO-f-2	Formulate solutions, procedures, and methods using first principles of mathematics for engineering sciences.	Cognitive Level 5 (Evaluating)	K7	P1 P3 P7	
PO-f-2	Analyze solutions for complex engineering problem reaching substantiated conclusion.	Cognitive Level 5 (Evaluating)	K7	P1 P3 P7	

XI – K, P, A Definitions

Indicator	Title	Description
K7	Comprehension of engineering in society	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability
P1	Depth of knowledge	Cannot be resolved without in-depth engineering knowledge at the level

	required	of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach
P3	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
P7	Interdependence	Are high level problems including many component parts or sub-problems

XII – Mapping of CO Assessment Method and Rubric

The mapping between Course Outcome(s) (COs) and The Selected Assessment method(s) and the mapping between Assessment method(s) and Evaluation Rubric(s) is shown below:

COs	Description	Mapped POs	Assessment Method	Assessment Rubric
CO1	**Explain** various concepts from Artificial Intelligence and Expert System research domain using various complex problems considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.	PO-f-1	Quiz / Term Exam	Rubric for Quiz / Term Exam
CO2	**Understand** artificial intelligence and its related terms to gain the basic ideas of artificial intelligence so that students will be able to know about the metrics related to performance which will help them to differentiate between different types of Expert systems.	PO-f-1	Quiz / Term Exam	Rubric for Quiz / Term Exam
CO3	**Apply** different Artificial Intelligence techniques such as search algorithms, genetic algorithm, CSP and uncertainty etc. to solve different real-life problems.	PO-f-1	Assignment / Project / Term Exam	Rubric for Assignment / Project / Term Exam
CO4	**Analysis and design** of different AI techniques to provide valid conclusions in real life problem solving.	PO-f-2	Assignment / Project / Term Exam	Rubric for Assignment / Project / Term Exam

XIII – Evaluation and Assessment Criteria

CO1: Explain various concepts from Artificial Intelligence and Expert System research domain using various complex problems considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.

Assessment Criteria	Not Attended/ Incorrect (0)	Inadequate (1-2)	Average (3)	Good (4)	Excellent (5)
Evaluation Criteria	**Evaluation Definition**				
Selection of Term	Explaining suitable term of AI to derive complexity of the given algorithms				
Content knowledge	Demonstrates approptite knowledge of AI practice and principles				
Selection and Argumentation	Articulates a position or argument for the choosing the correct practice and principles of AI				

CO2: Understand artificial intelligence and its related terms to gain the basic ideas of artificial intelligence so that students will be able to know about the metrics related to performance which will help them to differentiate between different types of Expert systems.					
Assessment Criteria	**Not Attended/ Incorrect (0)**	**Inadequate (1-2)**	**Average (3)**	**Good (4)**	**Excellent (5)**
Evaluation Criteria	**Evaluation Definition**				
Selection of Term	Explaining suitable term of AI to derive complexity of the given algorithms				
Content knowledge	Demonstrates approptite knowledge of AI practice and principles				
Selection and Argumentation	Articulates a position or argument for the choosing the correct practice and principles of AI				

CO3: Apply different Artificial Intelligence techniques such as search algorithms, genetic algorithm, CSP and uncertainty etc. to solve different real-life problems.					
Assessment Criteria	**Not Attended/ Incorrect (0)**	**Inadequate (1-2)**	**Average (3)**	**Good (4)**	**Excellent (5)**
Evaluation Criteria	**Evaluation Definition**				
Problem identification	Understand the problem context and nature of the problem. Describe appropriate algorithmic approach/paradigm to analyze the problem.				
Content knowledge	Demonstrates approptite knowledge of AI practice and principles for application of AI algorithms.				
Applicability	Apply suitable algorithms for the given problem for simulation of the problem.				

CO4: Analysis and design of different AI techniques to provide valid conclusions in real life problem solving.					
Assessment Criteria	**Not Attended/ Incorrect (0)**	**Inadequate (1-2)**	**Average (3)**	**Good (4)**	**Excellent (5)**
Evaluation Criteria	**Evaluation Definition**				
Problem Analysis	Understand the problem context and nature of the problem. Describe appropriate method or approach/paradigm to analyze the problem.				
Method Selection based on problem scenerio	Explore different dimensions of problems in terms of method considering the platforms where the implementation will be done.				
Analysis the result of the solution and find the drawbacks and constraints	To draw a conclusion describing the usage of the proposed techniques including the drawbacks and constraints.				

XIV- Course Requirements

- Students are expected to attend at least 80% class.
- Students are expected to participate actively in the class.
- For both terms, there will be at least 2 quizzes based on the theoretical knowledge and conceptual understanding of the topic covered discussed in the classes.
- Submit report based on the given course related problems.
- Submission of assignment and projects should be in due time.

XV – Evaluation & Grading System*

The following grading system will be strictly followed in this class:

Mid Term Exam:
Term Exam: 40%
Quizzes: 30%
Attendance & Performance: 10%
Lab Evaluation: 20%
Final Term Exam:
Term Exam: 40%
Quizzes: 30%
Attendance & Performance: 10%
Lab Evaluation: 20%
Semester grade: 40% midterm + 60% final term

Letter	Grade Point	Numerical %
A+	4.00	90-100
A	3.75	85 - < 90
B+	3.50	80 - < 85
B	3.25	75 - < 80
C+	3.00	70 - < 75
C	2.75	65 - < 70
D+	2.50	60 - < 65
D	2.25	50 - < 60
F	0.00	< 50
I		Incomplete
W		Withdrawal
UW		Unofficially Withdrawal

** The evaluation system will be strictly followed as par the AIUB grading policy.*

XII – Textbook/ References

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach," Fourth Edition, 2021.
2. John Paul Mueller , Luca Massaron, "Artificial Intelligence For Dummies", 2021.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer, Cham, 2018.
4. Martin T. Hagan, Howard B. Demuth, Mark H. Beale, "Neural Network Design," 2014.
5. Randy L. Haupt and Sue Ellen Haupt, "Practical Genetic Algorithms," Second Edition, 2004.
6. J. Ross Quinlan, "Programming for machine learning," Morgan Kaufmann, 1993.
7. David E. Goldberg, "Genetic Algorithms in Search, optimization and Machine learning," Pearson Education, 1989.
8. http://www.perfectlogic.com/articles/AI/ExpertSystems/ExpertSystems.html

XIII - List of Faculties Teaching the Course

DR. ASHRAF UDDIN
DR. ABDUS SALAM
DR. MOUSHUMI ZAMAN BONNY
SUPTA RICHARD PHILIP

XIV – Verification:

Prepared by : ----------	**Moderated by :** ----------	
Dr. Moushumi Zaman Bonny *Course Convener* Date:.....	**Dr. Mohammad Mahmudul Hasan** *Point Of Contact* *OBE Implementation Committee for CS* Date:.....	
Checked by: ..... **Dr. Akinul Islam Jony** *Head,* *Department of Computer Science* Date:.....	**Certified by:** ..... **Dr. Md. Abdullah-Al-Jubair** *Director,* *Faculty of Science & Technology* Date:.....	**Approved by:** ..... **Dr. Dip Nandi** *Associate Dean,* *Faculty of Science & Technology* Date:.....