AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

Faculty of Science and Technology (FST)
Department of Computer Science (CS)
Undergraduate Program

COURSE PLAN	SEMESTER: Fall 2024-2025
I. Course Core and Title CSC 3217 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** CSC 2211 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.
- Discuss Probability, Bayes Theorem and Bayes Networks for problem solving.
- 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	
CO1	**Express** 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	**Explain** 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 **	**Demonstrate** 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 **	**Justify** 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	OBE Discussion. Introduction to AI: Definition of AI, Approaches of AI, Turing Test, Foundation of AI.	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, CO3	Uninformed Search: Problem-solving agent, Formulating problems, BFS, DFS, Iterative deepening search , Depth-limited search, Bi-directional search.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 4	CO1, CO2, CO3	Uninformed Search: Uniform Cost Search. Informed Search: Best first search, Heuristic functions, Greedy search, , A* search,	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 5	CO1, CO2, CO3	Adversarial search: Games, optimal strategies, Evaluation functions, min-max algorithm.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 6	CO3, CO4	Adversarial search: Alpha-beta pruning, cutting off search. Midterm Revision.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Midterm (Week 7)				
Week 8	CO1, CO2, CO3, CO4	Local Search Algorithms: Hill-climbing Search, Simulated Annealing, Local Beam Search. Genetic Algorithm: Biological Background, Basic Outline, Encoding system, Crossover, Mutation, Selection.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 9	CO1,CO2, CO3, CO4	Genetic Algorithm: Solving Example Problems using GA.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 10	CO1,CO2, CO3, CO4	Constraint Satisfaction Problems: Define CSPs, Backtracking search for CSPs.	Lecture, Question, Lab Practice	Assignment/Project, Quiz, Term Exam

Week 11	CO3, CO4	Improving backtracking efficiency: Most constrained variable- minimum remaining values (MRV), Variable and value ordering, Forward checking, constraints propagation- Arc consistency	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 12	CO3, CO4	Statistical Reasoning: Probability, Bayes Theorem, Bayesian Network, Application of Bayes Theorem, Bayes network inference problem.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 13	CO3, CO4	Introduction to Artificial Neural Networks: Objectives, History, Applications and Biological Inspiration of Artificial Neural Networks (ANN), ANN Architecture. Backpropagation Algorithm, Learning using Backpropagation.	Lecture, Question-answer, Lab Practice	Assignment/Project, Quiz, Term Exam
Week 14 .	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 15)				

** 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-2	Formulate solutions, procedures, and methods using first principles of mathematics for engineering sciences.	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 required	Cannot be resolved without in-depth engineering knowledge at the level 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	**Express** 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	**Explain** basic ideas of artificial intelligence so that students will be able to know about the metrics related to perform which will help them to differentiate between different types of Expert systems.	PO-f-1	Quiz / Term Exam	Rubric for Quiz / Term Exam
CO3	**Demonstrate** 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	**Justify** 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: Express 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 Attribute/Criteria	Missing/ Incorrect (0)	Inadequate (1-3)	Satisfactory (4-7)	Excellent (8-10)
Problem Understanding	Not answered or the presented description is incorrect.	The problem is understaood, but the terminologies are not used correctly.	The problem is explained with correct information containing little mistakes.	The problem is understood and presented correctly with all required information.
Demonstration with examples	The relevant example is not shown or explained.	The given example does not fit for the problem but has some relevances.	The given example is relevant but lacks adequate explanation.	The given example is relevant and demonstrated with a proper interpretation.

CO2: Explain basic ideas of artificial intelligence so that students will be able to know about the metrics related to perform which will help them to differentiate between different types of Expert systems.

Assessment Criteria	Missing/ Incorrect (0)	Inadequate (1-3)	Satisfactory (4-7)	Excellent (8-10)
Explanation	No/wrong explanation is given.	The explanation is not sufficient to illustrate the understanding of the given problem.	A correct explanation is provided but has little issues.	The given explanation is correct and appropriately presented to understand the problem.

Demonstration with examples	The relevant example is not shown or explained.	The given example does not fit for the problem but has some relevances.	The given example is relevant but lacks adequate explanation.	The given example is relevant and demonstrated with a proper interpretation.

CO3: Demonstrate different Artificial Intelligence techniques such as search algorithms, genetic algorithm, CSP and uncertainty etc. to solve different real-life problems.				
Assessment Attribute/Criteria	**Missing/ Incorrect (0)**	**Inadequate (1-3)**	**Satisfactory (4-7)**	**Excellent (8-10)**
Applicability	An incorrect method or no method is selected to solve the problem.	The problem is solved using the required method with major mistakes.	There are minor mistakes in the presented solution that is using a proper method.	An appropriate method is applied with all given requirements.
Demonstration	The demonstration is not provided or irrelevant for the given problem.	There is a little relevancy between the problem and the provided demonstration.	The relevant demonstration is given with little missing information or steps.	The demonstration is given with all the relevant information.

CO4: Justify different AI techniques to provide valid conclusions in real life problem solving.				
Assessment Attribute/Criteria	**Missing/ Incorrect (0)**	**Inadequate (1-3)**	**Satisfactory (4-7)**	**Excellent (8-10)**
Methodology	No appropriate method is used.	A proper method is used to solve the problem, but not presented in a correct way.	The used method is correct, but it is not complete and not fully understandable.	The used method is appropriate, complete and satisfy all requirements.
Justification	A wrong or no justification is presented.	The justification is given without a proper description.	An appropriate justification is provided with minor issues.	The justification is given with an appropriate description.

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: 50%
Quizzes: 20%
Attendance & Performance: 10%
Lab Evaluation: 20%

Final Term Exam:
Term Exam: 50%
Quizzes: 20%
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.*

** CO attainment will be achieved with 60% of the evaluation marks.*

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

FACULTY NAME	SIGNATURE
Dr. Ashraf Uddin	
Dr. Abdus Salam	
Supta Richard Philip	
Shahnaj Parvin	
Shaikat Das Joy	

XVIII – Verification

Prepared by:  ---------- **Supta Richard Philip** *Course Convener* Date:.....	**Moderated by:** ---------- **Dr. M. Mahmudul Hasan** *Point Of Contact* *OBE Implementation Committee* Date:.....	**Checked by:** ---------- **TBA** *Head (Undergraduate Program)* *Department of Computer Science* Date:.....
Verified by: ..... **Dr. Md. Abdullah-Al-Jubair** *Director* *Faculty of Science & Information Technology* Date:.....	**Certified by:** ..... **Prof. Dr. Dip Nandi** *Associate Dean,* *Faculty of Science & Information Technology* Date:.....	**Approved by:** ..... **Mr. Mashiour Rahman** *Dean,* *Faculty of Science & Information Technology* Date:.....