AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

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

COURSE PLAN — FALL 2020-2021

I. Course Core and Title

CSC4226: Artificial Intelligence and Expert System

II. Credit

3 credit hours (3 hours of Lab & 2 hours 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.
- Compare the learning agent with other agents.
- Solve problems using BFS, DFS, UCS, DLS and IDS search techniques.
- Solve informed search and exploration methods like A*, Hill Climbing, Genetic Algorithms etc.
- Solve Constraint satisfaction problems and search techniques in game playing.
- Analyze Logic representation in propositional and first-order logic.
- Solve the problem using Genetic Algorithm.
- Use Neural Network notations and architectures. Solve problems using perception learning rules.

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.	5				4
CO2	Justify reasoning choosing one or multiple concepts from Artificial Intelligence and Expert System research domain.		5			6.1
CO3	Explain proposed solution for professional engineering practice.			6		6.2

C: Cognitive; P: Psychomotor; A: Affective; S: Soft skills (CT: Critical Thinking, TS: Teamwork)
* *CO assessment method and rubric of COs assessment is provided in Appendix section*
** *The numbers under the 'Level of Domain' columns represent the level of Bloom's Taxonomy each CO corresponds to.*

**** The numbers under the 'PO Assessed' column represent the PO (appendix) each CO corresponds to.*

IX – Topics to be covered in Theory class*:

TOPICS	Specific Objective(s)	Time Frame	Suggested Activities	Teaching Strategy(s)	CO mapped
Introduction to AI	- Definition of AI - Approaches of AI - Turing Test - Foundation of AI	Week 1	Lecture LAB: Problem solution and implementation	Lecture notes, question-answer session.	
Intelligent Agent	Agent and Environment Types of Agents Learning agent Concept of Rationality Components of Agent Program	Week 2	Lecture LAB: Problem solution and implementation	Lecture notes, question-answer session.	CO1
Solving Problem by Searching	Problem-solving agent, Formulating problems, Example problems, Search strategies BFS, Uniform Cost Search, DSF, Depth-limited search, Iterative deepening search, Bi-directional search.	Week 3	Lecture, Quiz-1, LAB: Assignment-1	Group session.	CO2
Informed search	Best first search, Greedy search, A* search, Heuristic functions, IDA* and SMA* search, Iterative improvement algorithms, Hill-climbing Search, Simulated Annealing	Week 4	Lecture LAB: Problem solution and implementation	Lecture notes, question-answer session.	CO2
Genetic Algorithm	Biological Background, Basic Outline, Encoding system, Crossover, Mutation, Selection.	Week 5	Lecture, LAB: Assignment-1	Lecture notes, question-answer session	CO2
Adversarial search	Games, Optimal decisions in games, optimal strategies, the min-max algorithm, optimal decisions in	Week 6	Lecture, Quiz-2, LAB: Assignment-2	Lecture notes, question-answer session.	CO2

	multiplayer games, Alpha-beta pruning, Imperfect decisions, Evaluation functions, cutting off search, Games including elements of chance.				
Mid Semester Assessment Week 7					
Constraint Satisfaction Problems	Constraint Satisfaction Problems, Backtracking search for CSPs, Variable and value ordering, propagating information through constraints, Intelligent backtracking: looking forward	Week 8	Lecture, LAB: Problem solution and implementation	Lecture notes, question-answer session.	CO2
Knowledge & Reasoning	Representing Knowledge using Logic. Propositional vs. First-order Logic, Inference, Advantages of FOL, Application of FOL.	Week 9	LAB: Problem solution and implementation	Lecture notes, question-answer session.	CO3
Expert System	Introduction, Architecture, Participants, and Components of Expert System	Wee 10	Lecture, Discussion, Presentation	Lecture notes, question-answer session.	CO4
Statistical Reasoning	Probability, Bayes Theorem, Bayes Network, Application of Bayes Theorem, Hidden Markov Model	Week 11	Lecture, Quiz-1, LAB: Problem solution and implementation	Lecture notes, question-answer session.	CO3
Introduction to Artificial Neural Networks	Objectives, History, Applications and Biological Inspiration of Artificial Neural Networks	Week 12	Lecture, Quiz-2, LAB: Problem solution and implementation	Lecture notes, question-answer session.	

Review Topics	Discuss Topics Important for the AI Community	Week 13	Discussion	Discussing Individual Student's Problem about the Subject Matter	
Final Assessment Week 14					

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

XI- Course Requirements

At least **80% class attendance** is necessary to sit for the exam. If there is an assignment given to the students, they have to submit it before the deadline decided by the course teacher.

XII – Evaluation & Grading System

The following grading system will be strictly followed in this class

Marking system for Theory Classes (Midterm and Final term)	
Quizzes	20%
Attendance	10%
Assignment & Performance	10%
Midterm/Final term exam	60%
Total	100%

Final Grade/ Grand Total

Midterm:	40%
Final Term:	60%

Marking system for Laboratory Classes (Midterm and Final term)	
Lab Report	30%
Attendance	10%
Viva & Performance	20%
Midterm/Final term exam	50%
Total	100%

Final Grade/ Grand Total

Midterm:	40%
Final Term:	60%

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

Letter	Grade Point	Numerical %
A+	4.00	90-100
A	3.75	85-89
B+	3.50	80-84
B	3.25	75-79
C+	3.00	70-74
C	2.75	65-69
D+	2.50	60-64
D	2.25	50-59
F	0.00	<50(Failed)

XIII – Teaching Methods

Maximum topics will be covered from the textbook. For the rest of the topics, reference books will be followed. Some Class notes will be uploaded on the web. White board will be used for most of the time.
For some cases, multimedia projector will be used for the convenience of the students.
Students must study up to the last lecture before coming to the class and it is suggested that they should go through the relevant chapter before coming to the class. Just being present in the class is not enough- students must participate in classroom discussions.

XIV – Textbook/ References

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach," Prentice Hall, Second Edition, 2003.
2. J. Ross Quinlan, "Programming for machine learning," Morgan Kaufmann, 1993.
3. Philip D. Wasserman, "Neural Computing Theory and Practice," Van Nostrand Reinhold, 1989.
4. Martin T. Hagan, Howard B. Demuth, Mark H. Beale, "Neural Network Design," 2002.
5. Randy L. Haupt and Sue Ellen Haupt, "Practical Genetic Algorithms," Second Edition, 2004.
6. David E. Goldberg, "Genetic Algorithms in Search, optimization and Machine learning," Pearson Education, 1989.
7. Carl Townsend, "Introduction to Turbo Prolog," First Edition (Revised), 2000.
8. http://www.perfectlogic.com/articles/AI/ExpertSystems/ExpertSystems.html

XV - List of Faculties Teaching the Course

SAJIB HASAN [1401-1485-2]
DR. DEBAJYOTI KARMAKER [2001-2055-2]
MD. SIYAMUL ISLAM [1909-2002-2]
MD. ASIFUL ISLAM [1801-1828-2]

XVI – Verification:

Prepared by : --- **Sajib Hasan** *Course Convener* Date:.....	**Moderated by :** --- **Dr. Mahbub Chowdhury Mishu** *Point Of Contact* *OBE Implementation Committee for CS* Date:.....	
Checked by: ..... **Dr. M. M. Mahbubul Syeed** *Head,* *Department of Computer Science* Date:.....	**Certified by:** ..... **Dr. Dip Nandi** *Director,* *Faculty of Science & Information Technology* Date:.....	**Approved by:** ..... **Mr. Mashiour Rahman** *Associate Dean,* *Faculty of Science & Information Technology* Date:.....

APPENDIX

Program Outcomes (POs)

PO4	Investigation
4	Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.
PO6	**The engineer and society**
6.1	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues
6.2	Assess the consequent responsibilities relevant to professional engineering practice.

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:

CO	Description	Learning Domain	Assessment Method	Assessment Rubric
CO1	***Explain*** various concepts from Artificial Intelligence and Expert System research domain using various complex problems.	Cognitive	**Quiz**	**Rubric for quiz**
CO2	***Justify*** reasoning choosing one or multiple concepts from Artificial Intelligence and Expert System research domain.	Psychomotor	**Lab Performance**	**Rubric for lab performance**
CO3	***Explain*** proposed solution for professional engineering practice.	Affective	**Presentation**	**Rubric for presentation**

Rubric for Quiz Assessment (CO1)

Marking Criteria	Marks Distribution (Maximum 3X5=15)				Acquired Marks
	Inadequate (1-2)	Satisfactory (3)	Good (4)	Excellent (5)	
Definition	• Student vaguely defines the terms or the concept.	• Definition provided with partial relevance to the subject matter.	• Correctly define the terms. May miss minor detail.	• Comprehensively defines the terms.	
Logical Argument	• No logical arguments / explanation supporting the definition.	• Offers lossy related arguments.	• Strong argument / explanation offered.	• Comprehensive argument presented to clarify the concept.	
Relevant Example	• No representative example. • No appropriate figure provided.	• Correctly identify / indicate towards real-life example. • Appropriate figure provided.	• Real-life example is strongly connected towards the definition. • Well defined /fully structured appropriate figure provided.	• Comprehensively defend with real life example. • Well documented fully structured appropriate figure provided.	
				Acquired Marks:	
				CO Pass / Fail:	

Rubric for Lab Performance Assessment (CO2)

Criteria	Marks distribution (Max 4X5 = 20)				Acquired Marks
	Inadequate (1-2)	Satisfactory (3)	Good (4)	Excellent (5)	
Execution of correct commands	• Failed to demonstrate basic concepts of lab exam	• Demonstrate concepts of lab exam with some minor errors	• Failed to demonstrate clear concepts of lab exam	• Demonstrate concepts of lab exam with clear understanding	
Percentage of competition	• Mis-configuration with major errors	• Configuration with minor errors	• Configured with partial success in the algorithm design	• Configured with full functionalities of the algorithm	
Following instructions	• Clearly failed to follow the verbal and	• Partially follow the verbal and written	• Failed to follow some of the verbal and	• Follow all the verbal and written	

	written instruction for a successful lab task	instruction for a successful lab task	written instruction for a successful lab task	instruction for a successful lab task	
Completion duration	• Failed to do basic requirement in the allotted amount of time	• Failed to configure major parts of the lab task in the allotted amount of time	• Unsuccessful to configure the entire lab task in the allotted amount of time	• Successfully configured the entire lab task in the allotted amount of time	
				Acquired Marks:	
				CO Pass/Fail:	

Rubric for Presentation Assessment (CO3)

Criteria	Marks distribution (Max 5X5 = 25)				Acquired Marks
	Inadequate (1-2)	Satisfactory (3)	Good (4)	Excellent (5)	
Presentation skill	• Student incorrectly pronounces terms and speaks too quietly for audiences in the back of the class to hear.	• Student incorrectly pronounces term. Audience members have difficulty hearing presentation.	• Student's voice is clear. Student pronounce most words correctly.	• Student uses a clear voice and correct, precise pronunciation of terms.	
Presenting relevant and logical content	• Audience cannot understand presentation because of no sequence of information.	• Audience has difficulty following because student jumps around presentation.	• Student presents information in logical sequence which audience can follow.	• Student presents information in logical, interesting sequence which attract the audience.	
Evidence / Reference	• Presents a lot of inaccurate and/or irrelevant evidence • Doesn't present enough evidence to support argument, even when	• Presents evidence that is somewhat inaccurate and/or irrelevant, but corrects when prompted • Does not present enough	• Presents evidence that is mostly relevant and/or mostly accurate • Presents limited evidence to support argument	• Presents evidence that is relevant and accurate • Presents sufficient amount of evidence to support argument	

	prompted repeatedly	evidence to support argument, but augments when prompted			
Implications	• Doesn't discuss the implications of the argument or position	• Discusses minor implications (missing the major ones) OR does not discuss major implications adequately	• Adequately discusses some of the major implications of the position	• Fully discusses the major implications of the argument or position	
Overall Understanding	• Shows no understanding of the topic and no argument per the categories above.	• Shows a superficial understanding of the topic, argument not developed enough per the categories above.	• Shows a limited understanding of the topic, not quite a fully developed argument per the categories above.	• Shows a deep/robust understanding of the topic with a fully developed argument per the categories above.	
				Acquired Marks:	
				CO Pass/Fail:	