



Bangladesh University of Business and Technology (BUBT)
Faculty of Engineering & Applied Sciences (FEAS)
Department of Computer Science and Engineering (CSE)

THEORY COURSE OUTLINE

1	Program	B.Sc. Engg. in CSE											
2	Course Code	CSE 351											
3	Course Title	Artificial Intelligence and Expert Systems											
4	Course Type	Core Course											
5	Academic Session	Spring 2021											
6	Credit Hour	3.0											
7	Intake	39											
8	Section	1											
9	Pre-requisites	CSE 241- Algorithms											
10	Campus	Permanent Campus											
11	Course Teacher	Name: Dr. M. Firoz Mridha		Designation: Associate Professor									
		Specialization: Artificial Intelligence, Machine Learning, Deep Learning, Natural Language Processing, Deep Learning											
		Room No. 312/B1	Email: firoz@bubt.edu.bd	Cell No. 01674791594									
12	Class Schedule	<table><tr><td>Class Day</td><td>Class Hours</td><td>Class Room</td></tr><tr><td>Monday</td><td>11:30 AM – 12.50 PM</td><td>319 (B-2)</td></tr><tr><td>Wednesday</td><td>11:30 AM – 12.50 PM</td><td>320 (B-2)</td></tr></table>			Class Day	Class Hours	Class Room	Monday	11:30 AM – 12.50 PM	319 (B-2)	Wednesday	11:30 AM – 12.50 PM	320 (B-2)
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13	Counselling Schedule	<table><tr><td>Class Day</td><td>Class Hours</td><td>Class Room</td></tr><tr><td>Sunday</td><td>1:20 PM – 2.40 PM</td><td>312(B-2)</td></tr><tr><td>Tuesday</td><td>1:20 PM – 2.40 PM</td><td>312(B-2)</td></tr></table>			Class Day	Class Hours	Class Room	Sunday	1:20 PM – 2.40 PM	312(B-2)	Tuesday	1:20 PM – 2.40 PM	312(B-2)
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14	Course Objectives	The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning. Upon successful completion of this course student will be able to design a knowledge based systems. Students will be familiar with terminology used in this topical area, and have read and analyzed important historical and current trends addressing artificial intelligence.											
15	Course Synopsis	Introduction to old and new AI techniques; Knowledge representation; Propositional and first order logic, inference in first order logic; Frame problem; Search techniques in AI; Game playing; Planning; Probabilistic reasoning; uncertainty, Learning in symbolic and non-symbolic representation; Bayesian Network; Introduction to artificial neural network; concept of perceptron and learning algorithm; AND network, OR network; Introduction to genetic algorithms; Agents and structure of different agents											
16	Text Book	1. Artificial Intelligence: A Modern Approach - Stuart Russel & Peter Noervig											
17	Reference Book	1. Artificial Intelligence: A Guide to Intelligent Systems - Michael Negnevitsky 2. Introduction to Artificial Intelligence and Expert Systems - Dan W. Patterson											

18	Course Outcomes (COs)	Upon completing this course students will be able to: CO1: Describe the fundamentals of AI, logic, knowledge representation and general understanding of AI principles and practice. 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 intelligence systems. CO3: Apply different Artificial Intelligence techniques such as search algorithms, genetic algorithm, and uncertainty etc. to solve different real-life problems. CO4: Analysis of different AI techniques to provide valid conclusions in real life problem solving.																																																																	
	Mapping of COs to POs	<table><tr><td>CO</td><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td></tr><tr><td>CO1</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO3</td><td></td><td></td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO4</td><td></td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	CO1	√												CO2	√												CO3			√										CO4		√										
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19	Teaching Strategy	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. Multimedia projector and a PC will be used for the convenience of the students to understand codes practically. Students must participate in classroom discussions for case studies, problems solving and project developments.																																																																	
20	Assessment and Marks Distribution:	<table><tr><td>Class Participation</td><td>:</td><td>10%</td></tr><tr><td>Assignment/Presentation</td><td>:</td><td>10%</td></tr><tr><td>Class Test</td><td>:</td><td>10%</td></tr><tr><td>Midterm Examination</td><td>:</td><td>30%</td></tr><tr><td>Final Examination</td><td>:</td><td>40%</td></tr></table>	Class Participation	:	10%	Assignment/Presentation	:	10%	Class Test	:	10%	Midterm Examination	:	30%	Final Examination	:	40%																																																		
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21	Lecture Plan (Weekly Schedule)					
	Week	Lecture #	Selected Topics	Chapter #	COs	Assessment
	1	1	Introduction to AI and Different Approaches to AI	01	CO1	Mid Term Exam 30
		2	Characteristics and Applications of AI	01	CO1	
	2	3	Intelligent Agents, Specifying Task Environment	02	CO2	
		4	Structure of Agents	02	CO2	
	3	5	Solving Problems by Searching: Introduction, Problem Solving Agents	03	CO3	
		6	Toy Problem & Real World Problem	03 CT-1	CO3	
	4	7	Solving Problems by Searching: Uninformed Search	03	CO3	
		8	Uninformed Search: BFS, UCS and DFS	03	CO3	
	5	9	Uninformed Search: DLS, IDS Informed Search: Best First Search	03	CO3	
		10	Informed Search: A* Search, Heuristic Search Beyond Classical Search: Hill Climbing Search, Simulated	03	CO3	
	6	11	Beyond Classical Search: Hill Climbing Search (Continued)	04	CO3	
		12	Example and Problem Solving on searching	04	CO3	
	7	13	Introduction to Propositional Logic	08	CO2	
		14	First Order Logic Reasoning and Reasoning	08	CO2	
	8	Midterm Examination				
	9	15	Problem Solving Based on Reasoning	08	CO3	Final Exam 40
		16	Uncertainty: Basic Probability Notations, The Axioms of Probability, Bayes' Rule and it's Use	13	CO3	
	10	17	The semantics of Bayesian Networks, Efficient representation of conditional distributions	23 CT-2	CO3	
		18	Problems solving using Bayesian Network.	23	CO3	
	11	19	Introduction to Genetic Algorithms, Genetic Algorithm steps	14	CO2	
		20	Problem Solution based on Genetic Algorithm	Web	CO3	
	12	21	Artificial Neural Network : Introduction	Web	CO2	
		22	Artificial Neural Network: Examples	02	CO2	
	13	23	Artificial Neural Network : Concept of perceptron	02	CO4	
		24	Learning Algorithm, AND, OR gate perceptron learning	02	CO4	
	14	25	Real world problem solving	02	CO4	
		26	Final Exam Review Class			
	15	Final Exam				

22	Overall CO Assessment Criteria	Assessment methods of COs are given below:						
		Assessment Area	CO				Assessment Area Mark	
			CO1	CO2	CO3	CO4		
		Class Participation						
		Assignment/Presentation						
		Class Test						
		Midterm Exam	10	10	10		30	
		Final Exam		10	10	20	40	
		Total Mark	10	20	20	20	70	
23	Rubrics	COs (Bloom's Level)	Excellent (80%-100%)	Good (70%-79%)	Satisfactory (60%-69%)	Poor (40%-59%)	Unsatisfactory (0-39%)	Marks (70)
		CO1 (Understanding)	Answer is complete and sufficient detail provided to support issues related to the question. And also deals fully with the entire question.	Answer is brief with sufficient detail provided to support issues were introduced. And most of the basic details are included but some are missing.	Answer is brief with insufficient detail provided to support issues were introduced.	Answer is incomplete and excessive discussion of unrelated issues. And serious gaps in the basic details.	None of the relevant details were included or didn't answer.	
		CO2 (Understanding)	Answer is complete and sufficient detail provided to support issues related to the question. And also deals fully with the entire question.	Answer is brief with sufficient detail provided to support issues were introduced. And most of the basic details are included but some are missing.	Answer is brief with insufficient detail provided to support issues were introduced.	Answer is incomplete and excessive discussion of unrelated issues. And serious gaps in the basic details.	None of the relevant details were included or didn't answer.	
		CO3 (Applying)	The question is answered appropriately by applying the suggested method in the question.	The question is answered briefly by applying the suggested method in the question.	The question is answered correctly by applying the suggested method in the question but some steps are missing.	The question is answered incompletely by applying the suggested method in the question but some steps are correct.	No attempt to implement the suggested method.	
		CO4 (Analyzing)	A clear, complete, and properly ordered chain of analyzing steps (i.e. proper explanation of the procedure) is followed to answer the question.	The chain of analyzing steps is complete and correctly ordered but lack of expected explanation.	One or more intermediate analyzing steps are missing or unclear, but the correctness of the analysis is not compromised.	One or more intermediate analyzing steps are missing or unclear to answer the question.	The stated chain of analysis does not lead to the stated question.	

24	Grading Policy	The following chart will be followed for grading. This has been customized from the guideline provided by the School of Engineering and Computer Science.																												
		<table><tr><td>A+</td><td>A</td><td>A-</td><td>B+</td><td>B</td><td>B-</td><td>C+</td><td>C</td><td>D</td><td>F</td></tr><tr><td>≥ 80</td><td>75-<80</td><td>70-<75</td><td>65-<70</td><td>60-<65</td><td>55-<60</td><td>50-<55</td><td>45-<50</td><td>40-<45</td><td><40</td></tr></table>								A+	A	A-	B+	B	B-	C+	C	D	F	≥ 80	75-<80	70-<75	65-<70	60-<65	55-<60	50-<55	45-<50	40-<45	<40	
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25	Additional Course Policies	Assignments	There will be at least two assignments. Average marks of the assignments will be counted. No late homework will be accepted. Any kind of copy/manipulation in assignment will carry zero mark. Two or more copied assignments will carry zero mark in all assignments. Zero tolerance will be shown in this regard. Solutions to assignment problems will be provided through web and on hand.																											
		Class Test	There will be at least three class tests (CT).Best two of three or best three of four CTs will be counted. Both of regular and surprise CTs can be conducted.																											
		Exams	CT, Mid-term and final exam will be closed book, closed notes. Mobile phone is strictly prohibited in exam hall. Students are insisted to carry their own watch and synchronize time during exam hours.																											
		Test Policy	If a student is absent from class test anyway and made no report to the class teacher personally beforehand, his/her score for that test will be zero. No make-up for the class test will be allowed as 2 of 3 or 3 of 4 CTs are being considered. No make-up for Mid-exam will be entertained without physical presence and recommendation of the guardian along with written permission of the department. Make-up of Mid-exam may be much harder than the regular one.																											
26	Additional Information	a. Academic Calendar Summer 2020: http://www.bubt.edu.bd/academics/academic-calendar . b. Academic Policies: http://www.bubt.edu.bd/academics/academic-rules-a-regulations . c. Grading & Evaluation: http://www.bubt.edu.bd/academics/academic-rules-a-regulations . d. Proctorial Rules: http://www.bubt.edu.bd/administrator/proctors-office .																												
27	Bloom’s Taxonomy for Teaching-Learning																													
Bloom's Taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in Cognitive, Affective and Psychomotor domains. The Cognitive domain list has been the primary focus of most education and is frequently used to structure curriculum learning objectives, assessments and activities. The three domains and respective levels are illustrated below.																														
<table><tr><th>Cognitive [C] (Knowledge-based)</th><th>Affective [A] (Emotion-based)</th><th>Psychomotor [P] (Action-based)</th></tr><tr><td>1. Remembering</td><td>1. Receiving</td><td>1. Imitating</td></tr><tr><td>2. Understanding</td><td>2. Responding</td><td>2. Manipulating</td></tr><tr><td>3. Applying</td><td>3. Valuing</td><td>3. Précising</td></tr><tr><td>4. Analyzing</td><td>4. Organizing</td><td>4. Articulating</td></tr><tr><td>5. Evaluating</td><td>5. Characterizing</td><td>5. Naturalizing</td></tr><tr><td>6. Creating</td><td>--- --- ---</td><td>--- --- ---</td></tr></table>										Cognitive [C] (Knowledge-based)	Affective [A] (Emotion-based)	Psychomotor [P] (Action-based)	1. Remembering	1. Receiving	1. Imitating	2. Understanding	2. Responding	2. Manipulating	3. Applying	3. Valuing	3. Précising	4. Analyzing	4. Organizing	4. Articulating	5. Evaluating	5. Characterizing	5. Naturalizing	6. Creating	--- --- ---	--- --- ---
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28	Descriptions of Cognitive Domain (Anderson and Krathwohl's Taxonomy 2001): The cognitive domain involves the development of our mental skills and the acquisition of knowledge.			
	Level	Category	Meaning	Keywords
	C1	Remembering	Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information.	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write
	C2	Understanding	Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining.	Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report
	C3	Applying	Carrying out or using a procedure through executing, or implementing. Applying relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations.	Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use
	C4	Analyzing	Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are differentiating, organizing, and attributing, as well as being able to distinguish between the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.	Analyze, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure
	C5	Evaluating	Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation.	Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, Monitor
	C6	Creating	Putting elements together to form a coherent or functional whole ;reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product. This process is the most difficult mental function.	Construct, design, develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce
29	Graduate Attributes (Program Outcomes) for B.Sc. in Engineering Program based on Washington Accord			
	<p>Program Outcomes (POs) are narrower statements that describe what students are expected to know and be able to do by the Time of graduation. These relate to the knowledge skills and attitudes that students acquire while progressing through the program. The students of the B.Sc. in EEE program are expected to achieve the following graduate attributes or program outcomes at the time of graduation.</p> <p>PO1–Engineering knowledge (Cognitive): Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.</p> <p>PO2–Problem analysis (Cognitive): Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.</p> <p>PO3–Design/development of solutions (Cognitive, Affective): Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.</p> <p>PO4–Investigation (Cognitive, Psychomotor): Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.</p> <p>PO5–Modern tool usage (Psychomotor, Cognitive): 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.</p> <p>PO6–The engineer and society (Affective): Apply reasoning informed by contextual knowledge to assess societal, health,</p>			

	<p>safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.</p> <p>PO7–Environment and sustainability (Affective, Cognitive): Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.</p> <p>PO8–Ethics (Affective): Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.</p> <p>PO9–Individual work and teamwork (Psychomotor, Affective): Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.</p> <p>PO10–Communication (Psychomotor, Affective): Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.</p> <p>PO11–Project management and finance (Cognitive, Psychomotor): Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.</p> <p>PO12–Life-long learning (Affective, Psychomotor): Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.</p>		
30	Social & Moral Capital		
	<p>Our promises are based on the three cardinal principles: (a) What we do believe (b) What we do practice, and (c) What we will promote</p> <p>However, students are advised to undertake the following commitments for moral development.</p>		
	<ol style="list-style-type: none"> 1. To be punctual and attentive in class 2. To maintain inclusive learning environment 3. To ensure mutual respect 4. To be cooperative in group learning. 5. To be innovative and Creative 6. To follow dress code and wearing ID card 7. To be always proactive 	<ol style="list-style-type: none"> 8. Try to follow and review day to day class 9. To avoid conspiracy 10. To prioritize honesty & faith 11. To be motivated for asking question and encourage feedback 12. To develop attitude for speaking in English 13. Do not ignore to carry out any assignments or commitments 14. To be clean and decent in all levels. 	<ol style="list-style-type: none"> 15. To be sincere for class preparation 16. Do not forget to switch-off the cell phone in class 17. Do not forget to carry course pack and learning stuffs in class 18. To maintain loyalty and trust to the university 19. Must avoid unfair means and plagiarism in exam, reports and assignments 20. Must maintain eco-friendly environment in the campus.

Prepared by:

Checked by:

Approved by: