



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING BANGLADESH UNIVERSITY OF BUSINESS AND TECHNOLOGY

COURSE OUTLINE

1	Faculty	Faculty of Engineering & Applied Sciences (FEAS)					
2	Department	Department of Computer Science and Engineering					
3	Program	B.Sc. Engg. in Computer Science and Engineering (B. Sc. Engg. in CSE)					
4	Course Code	CSE 351 (BNQF Code: *****)					
5	Course Title	Artificial Intelligence and Expert System					
6	Course Type	Core Engineering Course					
7	Pre-requisites	N/A					
8	Credit Hours/Value	3.0					
9	Contact Hours	17 weeks × 2 classes per week × 1.25 hours per class = 42.5 total hours					
10	Year- Semester	3 - 2					
11	Academic Session	Fall 2025					
12	Class Schedule	Intake – Section (Shift)	Class Day	Class Hours	Venue		
		BUBT Campus, Rupnagar, Mirpur 2, Dhaka - 1216					
13	Course Website	Google Classroom Code:		Meet Link:			
14	Course Teacher's Information	Name (Code):	Specialization:				
		Designation:	Email:				
			Cell No.	Room No.			
15	Counselling Hour/Tutorial	Day	Counseling Hours	Venue			
		Monday	10:30 am – 11:45 am				
		Wednesday	11:45 am – 01:00 pm				
		Thursday	01:30 pm – 02:45 pm				
16	Accessories & Aids	Students must carry learning materials like lecture notes, calculator, pen, pencil, eraser etc. in the classroom. Borrowing learning materials in the classroom or exam room from fellow students is prohibited. A student is also advised to keep a separate class note (khata) of 50 pages for the course during class hours.					
17	Course Rationale	AI course provides a comprehensive understanding of artificial intelligence concepts and applications. It covers foundational topics like machine learning, neural networks, and data analysis, equipping students with essential skills to develop AI-driven solutions. The course delves into ethical considerations, enabling students to navigate the social implications of AI. Practical projects and hands-on experience ensure proficiency in implementing AI algorithms, preparing students for roles in AI research, development, and integration across various industries. Overall, the course cultivates expertise in a rapidly evolving field critical to shaping the future of technology and society.					

18	Course Objective	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 students will be able to design 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.
19	Course Learning Outcomes (CLOs)	<p>Upon completing this course students will be able to:</p> <p>CLO1: Understand the concepts of Artificial intelligence, Intelligent Agents and issues in the design of search programs.</p> <p>CLO 2: Explain the concepts of Logical Agents, Uncertainty, Natural Language processing and Expert Systems. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.</p> <p>CLO 3: Analyze and simulate various searching techniques, constraint satisfaction problem and example problems- game playing techniques.</p> <p>CLO 4: Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.</p>

20 Mapping of CO – PO Method of Delivery and Assessment Tool				
CLOs	PLOs &CF	Bloom's Domain / Level	Delivery Methods / Activities	Assessment Tools
CLO1	PLO1 CF = 2	Cognitive/Understanding	<input checked="" type="radio"/> Classroom Lecture (PPP &/or WBT*) <input checked="" type="radio"/> Classroom Discussion& Exercise practice <input checked="" type="radio"/> Analysis and design problem solving <input checked="" type="radio"/> Course Counseling	Indirect: In class response, course counseling, course end survey Direct: Class participation and activity, class test, assignment, midterm and final examinations
CLO2	PLO1 CF = 3	Cognitive/Understanding		
CLO3	PLO2 CF = 3	Cognitive/Analyzing		
CLO4	PLO3 CF = 3	Cognitive/Applying		

*PPP: Power Point Presentation & WBL: White Board Teaching

Correlation of COs to POs

Correlation Criteria	Correlation Level	Correlation Factor (CF)
Less than 25%	Almost no correlation	0
Equal to or greater than 25% and below 50%	Poor (Low)	1
Equal to or greater than 50% and below 75%	Moderate (Medium)	2
Equal to or greater than 75%and up to 100%	Significant (High)	3

21	Teaching-Learning Strategy	The course's teaching-learning process is designed to achieve its intended learning outcomes. Various classroom tools, such as multimedia projectors with desktop computers, whiteboards, and overhead projectors, are used to make the process engaging, effective, and comprehensive. The primary method of teaching is through classroom lectures, wherein most of the course content is covered in the lecture notes. For the remaining topics, textbooks are utilized, with additional references provided for students to study on their own. Lecture materials are posted on Google Classroom web pages and also provided as hard copies in the classroom. To ensure that students achieve the expected performance and knowledge level, classroom discussions, PowerPoint presentations, problem-solving using whiteboard markers, and homework or home studies are used. Counseling is also offered to help students with weak areas. Formative assessments of individual students are done through inside and outside classroom discussions, in-class eye contact and clicker questions, homework, and students' responses. A course-end survey is also conducted. Summative assessments are done through class participation and performance observation, assignments, class
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		<p>tests, and semester midterm and final examinations.</p> <p>If a student is absent from a class for any reason, they are advised to do self-study and take tutorials from the class teacher to make up for the missed class. Supplementary examinations are available for students who missed the midterm or final examinations due to valid reasons. These supplementary exams are more challenging than the regular exams.</p>
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22 Course Plan				
Week	Selected Topics	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOs
1-2 (Week 1)	Introduction to AI and Different Approaches to AI, Characteristics and Applications of AI	Lecture, Video Presentation		CO1
3-4 (Week 2)	Intelligent Agents, Specifying Task Environment, Structure of Agents			CO1
5-6 (Week 3)	Solving Problems by Searching: Introduction, Problem Solving Agents, Toy Problem & Real World Problem			CO2
7-8 (Week 4)	Solving Problems by Searching: Uninformed Search, Uninformed Search: BFS, UCS and DFS	Lecture discussion with White Board and Multimedia, Problem Solving	Class Test, Assignment, Written Examination	CO3, CO4
9-10 (Week 5)	Uninformed Search: DLS, IDS, Informed Search: Best First Search, Informed Search: A* Search, Heuristic Search, Beyond Classical Search: Hill Climbing Search, Simulated			CO2
11-12 (Week 6)	Beyond Classical Search: Hill Climbing Search (Continued), Example and Problem Solving on searching			CO2
13-14 (Week 7)	Introduction to Propositional Logic, First Order Logic Reasoning and Reasoning	Lectures, Questions and answers	Problem Solving & Viva Voce	CO4
Midterm Examination				
15-16 (Week 8)	Problem Solving Based on Reasoning, Uncertainty: Basic Probability Notations, The Axioms of Probability, Bayes' Rule and its Use			CO2, CO3, CO4
17-18 (Week 9)	The semantics of Bayesian Networks, Efficient representation of conditional distributions, Problems solving using Bayesian Network.	Lecture	Class Test,	CO1, CO2

19-20 (Week 10)	Introduction to Genetic Algorithms, Genetic Algorithm steps, Problem Solution based on Genetic Algorithm	discussion with White Board and Multimedia, Problem Solving	Assignment, Problem Solving Ability and Written Examination	CO3
21-22 (Week 11)	Artificial Neural Network: Introduction, Artificial Neural Network: Examples			CO2
23-24 (Week 12)	Artificial Neural Network: Concept of perceptron, Learning Algorithm, AND, OR gate perceptron learning			CO3
25-26 (Week 13)	AND, OR gate perceptron learning			CO2, CO3
27-28 (Week 14)	Real world problem solving	Discussion and Problem Solving	Problem Solving Ability and Written Examination	CO3, CO4
29-30 (Week 15)	Real world problem solving			CO3, CO4
31-32 (Week 16)	Research Week			
33-34 (Week 17)	Solve class	Lectures, Questions and answers	Problem Solving & Viva Voce	CO3, CO4
Final Exam				

23 i	Text Books	1. Artificial Intelligence: A Modern Approach - Stuart Russel & Peter Noervig
ii	Reference Books	1. Artificial Intelligence: A Guide to Intelligent Systems - Michael Negnevitsky 2. Introduction to Artificial Intelligence and Expert Systems - Dan W. Patterson
24	Assessment and marks distribution criteria	Active engagement in class activities, participation in outside classroom discussions, and communication through the Internet and phone are integral parts of this course. Failure to participate in class regularly, take class tests, and/or complete assignments may result in failing the course. To achieve the course-specific expectations, students must actively participate in classroom discussions and complete all sets of work at a satisfactory level, as outlined in the course content. The course-specific expectations for students are achieved if

	<ul style="list-style-type: none"> ⦿ 75% of students in a section attend more than 70% of classes (determined by summative assessment). ⦿ Their active participation in the classroom discussion is targeted at up to 80% of the total attendees (determined by formative assessments such as eye contact, clicker questions, and group discussions). ⦿ Equal or more than 40% of course outcomes must be achieved by the students (summative assessment). ⦿ The level of engagement in the studies, such as regularly preparing class lectures, class tests, and assignments, must be more than 60% (formative assessment). ⦿ Expected level of participation in the outside class discussion (once weak, more than 30% of students in a section) by course counseling and using social media like Google Classroom, email, phone call, etc. (formative assessment). ⦿ Students are assessed according to their individual performance in the examinations, class tests, assignments, and class participation. The final mark calculation and course outcome assessment are done based on the following mark distribution criteria: 																								
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26	CLO Assessment Criteria	Assessment of CLOs					
		Assessment Tool	CLO				
			CLO1	CLO2	CLO3	CLO4	
		Class Participation	5/4	5/4	5/4	5/4	
		Class Test	5.0	10.0	0	0	
		Assignment& Presentation	0	5.0	5.0	0	
Midterm Exam		10	20	0	0	30	
Final Exam		05	10	15	10	40	
Total Mark		21.25	46.25	21.25	11.25	100	

27	Rubrics (Attainment Criteria)	CLOs (Taxonomy domain)	Not attained /Failed (0-39%)	Poor (40%-49%)	Moderate (50%-64%)	Good (65%-79%)	Excellent (80%-100%)
		CLO1 (understand) CLO2 (understand and apply) CLO3 (apply) CLO4 (understand and apply)	The question was answered with serious deficiencies in understanding and explanation. Applicable method was not almost touched.	The question was answered inadequately by touching on the applicable method or without explanations. As a result, a few steps of problem-solving procedures or concepts are not developed properly or are missing.	The question was answered partially correctly by applying the method or concepts asked, but a few important details were missing.	The question was answered correctly but briefly, and missed some portions of the important explanation by applying the required method or concepts.	The question was answered correctly with detailed explanations using the asking method of solving the problem or concepts with adequate explanation.

28	Feedback	All kinds of feedback to the students will be produced within a week after the day of holding a class test and midterm examination. No answer script will be shown for the final examination if it is not challenged by a student. Online and email queries will also be responded to within three days by email.
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29	Grading Policy	Letter grades and grade points are used to evaluate the performance of a student in the course:		
		Marks Range	Letter Grade	Grade Point
		80% and above	A+ : A Plus (Outstanding)	4.00
		75% to less than 80%	A : A regular (Excellent)	3.75
		70% to less than 75%	A- : A minus (Very good)	3.50
		65% to less than 70%	B+ : B Plus (Good)	3.25
		60% to less than 65%	B : B regular (Average)	3.00
		55% to less than 60%	B- : B minus (Below average)	2.75
		50% to less than 55%	C+ : C Plus (Poor)	2.50
		45% to less than 50%	C : C regular (Very poor)	2.25
		40% to less than 45%	D : Pass marginally	2.00
		Less than 40%	F : Fail	0.00
			I : Incomplete	
			R : Retake	
			W : Withdraw	

30	Additional Course Policies	Assignment	<p>Late assignment submissions will not be accepted.</p> <p>Any kind of copied information without proper citation (i.e., plagiarism) in the assignments or any other work is prohibited and treated as serious academic misconduct, which is prosecuted through the Discipline Committee of BUBT. All copied or plagiarized assignments/reports/test papers will be canceled, and the isolated student must prepare a new assignment/project again. Zero tolerance will be shown in this regard.</p> <p>Feedback after the submission of long assignments will be provided on hand or by email within two weeks.</p>
		Class Test	Two class tests (CTs) will be conducted for the course. All class tests have equal weightage of 7.5. Both regular and surprise CTs can be conducted.
		Closed book assessments	CTs, midterm and final examinations are closed book assessments. Mobile phone is prohibited in the examination hall. Students are insisted on carrying simple scientific calculators to solve the complex calculations and a wrist-watch to follow time during the exam hours.
		Test Policy	If a student is absent from a class test anyway and does not 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. No supplementary for midterm and final examinations will be entertained without physical presence and recommendation of the guardian, along with written permission of the department. Supplementary examination questions are much harder than the regular examination questions; therefore, students are discouraged from taking supplementary examinations.

31	Additional Information	<p>Academic Calendar Fall2023: https://www.bubt.edu.bd/Home/page_details/Academic_Calender</p> <p>Academic Rules: https://www.bubt.edu.bd/Home/page_details/Rules_and_Regulations</p> <p>Grading & Evaluation: https://www.bubt.edu.bd/Home/page_details/Evaluation_Grading_System</p> <p>Rules& Regulations: https://www.bubt.edu.bd/Home/page_details/Office_of_the_Registrar</p>
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32	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 specific quality. The three taxonomy domains for achieving learning objectives are cognitive, affective, and psychomotor. Cognitive domain is in the primary focus of educating and frequently used to structure curriculum learning objectives and achieve the level of learning. The three domains and their respective levels are illustrated below:			
	Cognitive [C] (Knowledge-based)	Affective [A] (Emotion-based)	Psychomotor [P] (Action-based)
	Remember	Receive	Imitate
	Understand	Respond	Manipulate
	Apply	Value	Precision
	Analyze	Organize	Articulation
	Evaluate	Characterize	Naturalization
	Create	-----	-----

33	Descriptions of Cognitive Domain (Anderson and Krathwohl's updated Taxonomy in 2001):		
The cognitive domain involves the development of our mental skills and the acquisition of knowledge.			
	Category (Level)	Meaning	Keywords
	Remember (C1)	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, and write
	Understand (C2)	Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting,	Classify, compare, exemplify, conclude, demonstrate, discuss,

	exemplifying, classifying, summarizing, inferring, comparing, or explaining.	explain, identify, illustrate, interpret, paraphrase, predict, and report
Apply (C3)	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, and use
Analyze (C4)	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, and structure
Evaluate (C5)	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, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, Monitor.
Create (C6)	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 in the new taxonomy.	Create, invent, compose, predict, plan, construct, design, propose, devise, and formulate

34 Graduate Attributes (Program Learning Outcomes) of B.Sc. in CSE Program based on Washington Accord	
	<p>Program Learning Outcomes (PLOs) are brief 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 throughout the entire course of a program. The students of the B.Sc. in CSE program are expected to achieve the following graduate attributes or program outcomes at the time of graduation:</p> <p>PLO1. Apply knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</p> <p>PLO2. Identify, formulate, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics and natural and engineering sciences.</p> <p>PLO3. Design solutions for complex engineering problems and design systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.</p> <p>PLO4. Conduct investigations of complex problems using research-based knowledge and research methods that include the design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.</p> <p>PLO5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering problems, with an understanding of the limitations.</p> <p>PLO6. Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems.</p> <p>PLO7. Understand and evaluate the sustainability and impact of professional engineering work to solve complex engineering problems in societal and environmental contexts.</p> <p>PLO8. Apply ethical principles and commit to professional ethics, responsibilities, and norms of engineering practice.</p> <p>PLO9. Function effectively as individuals and members or leaders of diverse teams and in multidisciplinary settings.</p> <p>PLO10. Communicate effectively on complex engineering activities with the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and convey and receive clear instructions.</p> <p>PLO11. Demonstrate knowledge and understanding of engineering and management principles and apply them to their work as team members or leaders or entrepreneurs to manage projects in multidisciplinary</p>

	<p>environments.</p> <p>PLO12. Recognize self-awareness to engage in a lifelong learning process to reflect in the broadest context of technological change.</p>
35	<p>Knowledge Profile (K)</p> <p>K1: A systematic, theory-based understanding of the natural sciences applicable to the discipline.</p> <p>K2: Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modeling applicable to the discipline.</p> <p>K3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.</p> <p>K4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline much is at the forefront of the discipline.</p> <p>K5: Knowledge that supports engineering design in a practice area.</p> <p>K6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.</p> <p>K7: Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.</p> <p>K8: Engagement with selected knowledge in the research literature of the discipline.</p>
36	<p>Range of Complex Engineering Problem Solving (P)</p> <p>Complex Engineering Problems have characteristic P1 and several or all of P2 to P7:</p> <p>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</p> <p>P2. Range of conflicting requirements: Involve wide-ranging or conflicting technical, engineering and other issues</p> <p>P3. Depth of analysis required: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models</p> <p>P4. Familiarity of issues: Involve infrequently encountered issues</p> <p>P5. Extent of applicable codes: Are outside problems encompassed by standards and codes of practice for professional engineering</p> <p>P6. Extent of stakeholder involvement and conflicting requirements: Involve diverse groups of stakeholders with widely varying needs</p> <p>P7. Interdependence: Are high-level problems including many component parts or sub-problems</p>
37	<p>Range of Complex Engineering Activities (A)</p> <p>Attribute Complex activities means (engineering) activities or projects that have several or all of the following characteristics:</p> <p>A1. Range of resources: Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies).</p> <p>A2. Level of interaction: Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering, or other issues.</p> <p>A3. Innovation: Involve creative use of engineering principles and research-based knowledge in novel ways.</p> <p>A4. Consequences for society and the environment: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.</p> <p>A5. Familiarity: Can extend beyond previous experiences by applying principles-based approaches.</p>

38 Code of Conduct
<p>It is strongly suggested that students keep discipline in the classroom by attending class on time, listening to lectures attentively, and participating in discussions on the subject. To get class participation grades, students MUST attend the classes of the courses s/he registered for. Turn off his or her cell phone before entering a class or participating in class tests and exams. There are activities that are considered academic misconduct. One of them is plagiarism, which signifies the deliberate formal presentation or submission of works, phrases, texts, ideas, illustrations, or diagrams of others as one's own without proper citation. Another one is the use of unauthorized aids (including electronic devices), asking for assistance, or using illegal materials when preparing assignments or in examinations. In addition, copying from others' work, showing your work to others, and asking for answers are also considered academic misconduct. Penalties for involving academic misconduct include one or more of the following: a zero grade on the work produced, a failing grade in the course, suspension for one semester or more, and even expulsion from the university. On the university premises or at a university-sponsored program, students must abide by the Student Code of Conduct and other Rules and Regulations of BUBT, which are available on the BUBT website at https://www.bubt.edu.bd/Home/page_details/Office_of_the_Proctor.</p>

39 Social & Moral Values			
<p>Our promises are based on the three cardinal principles:</p> <ul style="list-style-type: none"> i. What we do believe. ii. What we do practice. iii. What we will promote. <p>However, students are advised to undertake the following commitments for social and moral developments.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="vertical-align: top; width: 33%;"> <ul style="list-style-type: none"> • To be punctual and attentive in classes; • To prioritize honesty & faith; • To ensure mutual respect; • To be always proactive; • To avoid conspiracy; • To be cooperative in learning; • To be sincere in class preparation; </td> <td style="vertical-align: top; width: 33%;"> <ul style="list-style-type: none"> • To avoid unfair means and plagiarism in exams, report writings and assignments; • To carry out assignments or keep other commitments timely; • To be motivated for asking question and encourage feedback; • Not to forget to switch-off the cellphone in a class; </td> <td style="vertical-align: top; width: 33%;"> <ul style="list-style-type: none"> • To follow the dress code and wearing ID card on campus; • To be decent on all aspects; • To be loyal and trust-worthy to the teachers and others; • Help keeping an eco-friendly environment in the campus. </td> </tr> </table>	<ul style="list-style-type: none"> • To be punctual and attentive in classes; • To prioritize honesty & faith; • To ensure mutual respect; • To be always proactive; • To avoid conspiracy; • To be cooperative in learning; • To be sincere in class preparation; 	<ul style="list-style-type: none"> • To avoid unfair means and plagiarism in exams, report writings and assignments; • To carry out assignments or keep other commitments timely; • To be motivated for asking question and encourage feedback; • Not to forget to switch-off the cellphone in a class; 	<ul style="list-style-type: none"> • To follow the dress code and wearing ID card on campus; • To be decent on all aspects; • To be loyal and trust-worthy to the teachers and others; • Help keeping an eco-friendly environment in the campus.
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Prepared by:

Checked by:

Approved by: