Department of Software Engineering (SE)
Faculty of Science and Information Technology (FSIT)
Daffodil International University (DIU)
(Version 2.0)

Course Code: SE 444		**CIE Marks:** 60
ISCED: 0613-444		**SEE Marks:** 40
Course Title: Data Warehouse and Data Mining		**Total Marks:** 100
Semester: Spring 2024		
Credit Value: 3 (Theory)	**Contact Hours:** 2.5 (Total weeks: 18)	
Prerequisite: N/A		
Course Type: Core		
Level: 4	**Term:** 2	**Section:**

CIE: Continuous Internal Evaluation
SEE: Semester End Examination

Instructor Details

Name:	
Employee ID:	
Designation:	
Department:	
Office Address:	
Telephone/Extension:	
Mobile:	
Website:	
GTA/UTA(If Any):	

Class Schedule with Counseling Hour

Time/ Date	8:30 AM-9:45 AM	9:45 AM-11:00 AM	11:00 AM-12:15 PM	12:15 PM-1:30 PM	1:30 PM-2:45 PM	2:45 PM-4:00 PM	4:00 PM-5:15 PM	5:15 PM-6:30 PM
Saturday								
Sunday								
Monday								
Tuesday								
Wednesday								
Thursday								

Course Content (from syllabus)

Transactional Processing Vs. Decision Support Systems, Data Warehousing Fundamentals, Characteristics of Data Warehouse, Data Warehouse Architectures, Maturity Models, Potential Applications, OLTP, OLAP, Data Cubes, Fact Tables, Dimensions, Relational Models, Integrity Rules, Entity Relationship Diagrams, Modification Anomalies, Database Normalizations, Star Schema, Snowflake Schema, Constellation Schema, Time Representation, Types of Change, ETL, Naïve Bayes, Train-Test-Validation Set, Cross-Validation, Bootstrapping, Mean Square Error, Mean Absolute Error, Root Mean Square Error, Confusion Matrix, Accuracy, Precision, Recall, F1 Score, Association Rule Mining, Apriori Algorithm, Linear Regression, Logistic Regression, Decision Tree, K-Means Clustering, Agglomerative Clustering, Graph Theory, Graph Clustering.. Community Detection, Girvan Algorithm, Louvain Algorithm.

Rationale of the Course

Data warehouses collaborate data from several sources and ensure data accuracy, quality, and consistency. System execution is boosted by differentiating the process of analytics from traditional databases. In a data warehouse, data is sorted into a formatted pattern by type and as needed. The data is examined by query tools using several patterns. Data warehouses store historical data and handle requests faster, helping in online analytical processing, whereas a database is used to store current transactions in a business process that is called online transaction processing. On the other hand, in data mining, data is extracted and analyzed to fetch useful information. In data mining hidden patterns are researched from the dataset to predict future behavior. Data mining is used to indicate and discover relationships through the data. Data mining uses statistics, artificial intelligence, machine learning systems, and some databases to find hidden patterns in the data. It supports business-related queries that are time-consuming to resolve.

Course Objectives

The goal of this course is to introduce the students about the concept of Data warehouse and Data Mining principles. The main objectives of this course are:

- Students will be taught about the necessity and the appropriate scenarios where warehouse and data mining are relevant and beneficial.
- Students will be taught about different components and architectures of data warehouse.
- Students will be taught to apply different data mining algorithms.
- Students will be taught to evaluate and interpret the results of data mining algorithms.

Course Learning Outcomes (CLOs) with Mappings

At the end of the course, students will be able to:

CLOs	CLO Descriptions	Program Leeming Outcomes (PLOs)	Learning Domains (C, P, A)	BNQF Skill
CLO1	**Design** data warehouse architectures to solve real-world business problems.	PLO3	C6	Fundamental Domain

CLO2	**Apply** appropriate data mining algorithms to answer different business queries.	PLO2	C3	Fundamental Domain
CLO3	**Communicate** the findings of different data mining algorithms properly to the stakeholders.	PLO10	C5, A3, P3	Social, Thinking, Personal Domain
CLO4	**Evaluate** different components of a data warehouse – data mining solution for the correctness of design, analysis, and interpretation.	PLO4	C5	Fundamental Domain

Mapping of CLOs with PLOs

Course Learning Outcome	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√									
CLO2		√										
CLO3									√			
CLO4				√								

Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs:

Week/ Lesson (hour)	Lesson Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-1 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Introduction to course syllabus, assessment methods, learning outcomes, deadlines, consultation hour, code of conduct, and other administrative procedures regarding the course.	Classroom discussion, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
	Lesson 2: Difference between transactional processing and decision support systems, motivation, and characteristics of data warehouse.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
Week-2 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Data warehouse architectures, maturity levels, and applications of data warehouse.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture note.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
	Lesson 2: Difference between OLTP and OLAP systems, their advantages, and disadvantages, and use cases.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Midterm, Final	CLO1,CLO4

Week-3 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Data cubes, facts, dimensions, multidimensional terminologies, and data cube operations.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture note, Open discussion.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
	Lesson 2: Relational data model, integrity rules, entity relationships, and entity relationship diagrams. **Class Test - 1**	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
Week-4 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Modification anomalies, functional dependencies, and database normalization.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
	Lesson 2: Relational models for data warehouse, star schema, snowflake schema, constellation schema, and time representation.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
Week-5 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Data warehouse maintenance tasks, managing data sources, types of change of data, ETL process, etc.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
	Lesson 2: Workshop on the current trends and future scopes of data warehouses.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture note, Open discussion.	Class Test, Assignment, Midterm, Final	CLO1,CLO4
Week-6 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Introduction to data mining, its types, applications, scopes, and current trends.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Presentation, Midterm Final	CLO2,CLO3, CLO4
	Lesson 2: Understand, identify, and differentiate between different types of data, evaluate quality of the collected data, summarizing them by calculating central tendencies, spread, and bivariate relationships.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Presentation, Midterm Final	CLO2,CLO3, CLO4
Week-7	Lesson 1: Probability theory, dependent and independent events,	Brainstorming sessions, Classroom	Class Test, Assignment,	CLO2,CLO3, CLO4

Lesson 1 & 2 [2.5 Hours]	conditional probability, and Bayes' theorem.	discussion, Voice over PPT, Lecture note.	Presentation, Midterm Final	
	Lesson 2: Naïve Bayes algorithm. **Class Test - 2**	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Midterm Final	CLO2,CLO3, CLO4
Week-8 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Model training best practices, train / cross-validation / test data, bootstrapping, hyperparameter tuning, etc.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Presentation, Midterm Final	CLO2,CLO3, CLO4
	Lesson 2: Model evaluation metrics and best practices for classification and regression algorithms.	Classroom discussion, Voice over PPT, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Midterm Final	CLO2,CLO3, CLO4
Week-9 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Introduction to common terms and terminologies of association rules, calculating support and confidence of frequent itemset.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Presentation, Midterm Final	CLO2,CLO3, CLO4
	Lesson 2: Computational complexity of association rule mining and Apriori algorithm.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Midterm Final	CLO2,CLO3, CLO4
Week-10 Lesson 1 & 2 [2.5 Hours]	Lesson 1: K Means Clustering, Euclidean, Manhattan, and other distance metrics, their advantages, and disadvantages,	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4
	Lesson 2: Advantages and Disadvantages of K-Means clustering and different ways of solving them such as multiple initializations, elbow methods, etc.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4
Week-11 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Hierarchical / Agglomerative Clustering algorithm, identifying best clusters using Dendrograms.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4
	Lesson 2: Identifying best clusters using inter-cluster distance and intra-cluster distance (inertia), and other relevant metrics.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4

Week-12 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Linear Regression and Logistic Regression algorithms.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4
	Lesson 2: Decision Tree algorithm.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4
Week-13 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Introduction to Graph Theory.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4
	Lesson 2: Different types of Graphs, its connectivity and implementation. **Class Test - 3**	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Class Test, Assignment, Presentation, Final	CLO2,CLO3, CLO4
Week-14 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Graph Clustering Basics.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Assignment, Presentation, Final	CLO2,CLO3, CLO4
	Lesson 2: Graph Based Representations.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Assignment, Presentation, Final	CLO2,CLO3, CLO4
Week-15 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Similarity Measures in Graphs.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Assignment, Presentation, Final	CLO2,CLO3, CLO4
	Lesson 2: Different Graph Connectivity.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Assignment, Presentation, Final	CLO2,CLO3, CLO4
Week-16 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Community Detection Algorithm (Girvan Newman).	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Assignment, Presentation, Final	CLO2,CLO3, CLO4
	Lesson2: Community Detection Algorithm (Louvain).	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion	Assignment, Presentation, Final	CLO2,CLO3, CLO4
Week-17	Lesson 1: Evaluation Metrics for Graph Clustering.	Classroom discussion, Voice over PPT,	Assignment, Presentation,	CLO2,CLO3, CLO4

Lesson 1 & 2 [2.5 Hours]		Lecture note, Open discussion	Final	
	Lesson 2: Applications of Graph Clustering.	Classroom discussion, Voice over PPT, Lecture note, Open discussion	Assignment, Presentation, Final	CLO2,CLO3, CLO4
Week-18 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Overview of the entire course.	Classroom discussion, Voice over PPT, Lecture note.	Final	CLO2,CLO3, CLO4
	Lesson 2: Overview of the entire course.	Classroom discussion, Voice over PPT, Lecture note.	Final	CLO1,CLO2,CLO3, CLO4

Overall Assessment Scheme

Assessment Task	CLO's				Mark (Total=100)	PLO's				Mark (Total =65)
	CLO 1	CLO 2	CLO 3	CLO4		PLO2	PLO3	PLO4	PLO9	
Attendance	--	--	--	--	7					
Class Test 1	15				Avg 15					
Class Test 2		15								
Class Test 3				15						
Assignment				5	5					
Presentation			8		8					
Midterm Exam	10	10		5	25	10	10	5		25
Final exam	10	10	10	10	40	10	10	10	10	40

Marks Distribution

Class attendance	7
Assignment	5
Presentation (Mandatory)	8
3 Quizzes	15
Midterm Test	25
Semester Final Examination	40
Total	100

Evaluation Policy (Grading Policy)

Marks obtained out of 100	Grade	Grade point equivalent	Remarks
80% and above	A+	4.00	Outstanding
75% to less than 80%	A	3.75	Excellent
70% to less than 75%	A-	3.50	Very Good
65% to less than 70%	B+	3.25	Good
60% to less than 65%	B	3.00	Satisfactory
55% to less than 60%	B-	2.75	Above Average
50% to less than 55%	C+	2.50	Average
45% to less than 50%	C	2.25	Below Average
40% to less than 45%	D	2.00	Pass
Less than 40%	F	0.00	Fail

Class Make-up Procedure

Missed class will be taken at convenient free class hour.

Textbook/Recommended Readings

1. Database Design, Application Development, and Administration, by Michael Mannino, Sixth Edition, Chicago Business Press, 2015.

Reference Books/ Other Supplementary Readings

1. Data Mining: Practical Machine Learning Tools and Techniques by Mark A. Hall, Ian H. Witten, Eibe Frank, Christopher Pal, Third Edition, Morgan Kaufmann. 2011.

Course Materials and Slides

All course materials and slides will be available in DIU Blended Learning Center, and Google classroom. (Everyone is requested to join google classroom and BLC account).

Software/Tools used

1. Python
2. MySQL
3. PowerBI
4. Excel

Exam Dates

According to the Examination Schedule

Academic Code of Conduct

Academic Integrity:

Academic offenses under the Academic Code of Conduct include plagiarism, personification, physical and online cheating, falsification of a document, and any other dishonest behavior related to gaining academic gain or avoiding evaluation exercises by a student. The university's Disciplinary Committee may decide to impose severe penalties for these offenses.

Special Instructions:

- Attendance at all classes and exams is required of the students. To take the final test, a student needs to have attended at least 70% of classes.
- After ten minutes of the scheduled start time, students will not be permitted to enter the classroom.
- Plagiarism will automatically result in a zero on that exam or assignment.
- There won't often be a make-up exam. However, if a student misses an exam due to a serious sickness, the death of a family member, an emergency involving the family, or humanitarian reasons, they MUST request permission to make up the exam in writing through the course instructor to the chairperson within 48 hours of the exam date. The application must be submitted with the appropriate supporting documentation for the reason(s) for the absence from the exam.
- There won't be a makeup exam for the final exam. However, if a student is unable to attend the final exam due to a serious illness, a family member's death, an emergency, or humanitarian reasons, they MUST request an incomplete grade in writing from the course instructor via the chairperson within 48 hours of the exam date. Along with the application, appropriate supporting documentation for the reason(s) for missing the final exam must be provided. It is the student's duty, in consultation with the course instructor, to schedule an incomplete exam by the deadline specified in the academic calendar.
- It is required that all cell phones be in silent mode during class and test times.
- Exam cheating is not tolerated at all. Examinees will be penalized for cheating if they are found in possession of cheat sheets, used or not; if they write on their palms, the backs of calculators, chairs, or adjacent walls; if they copy from cheat sheets or other sources; if they copy from other examiners, etc. Cheating only carries a single, multi-semester expulsion, as determined by the university's disciplinary committee.

Appendix

Program Learning Outcomes (POs)

No.	Program Learning Outcomes
PLO1	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PLO2	Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.

PLO3	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 and of cultural, societal and environmental concerns.
PLO4	Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.
PLO5	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 their limitations.
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.
PLO7	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PLO8	Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.
PLO9	Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.
PLO10	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.
PLO11	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.
PLO12	Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

Learning Domain

Cognitive Domain(Knowledge):

Levels	Definition
Remember (C1)	**Definition:** Retrieving, recalling, or recognizing information from memory.

Understand(C2)	**Definition:** Changing from one form of representation to another; illustrating a concept; drawing conclusions; determining cause and effect
Apply(C3)	**Definition:** Using learned materials, students can use/apply information in a new way
Analyze(C4)	**Definition:** Breaking material or concepts into parts, determining how the parts related or interrelated to one another or to an overall structure or purpose.
Evaluate(C5)	**Definition:** Assessing, making judgments and drawing conclusions from ideas, information, or data.
Create(C6)	**Definition:** developing a hypothesis; devising a procedure; inventing a product

Affective Domain:

The affective domain includes how learners deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

Level	**Definition:**
Receiving (A1)	Being aware of or attending to something in the environment.
Responding(A2)	Showing some new behaviors as a result of experience.
Valuing(A3)	Showing some definite involvement or commitment.
Organization(A4)	Integrating a new value into one's general set of values, giving it some ranking among one's general priorities.
Characterization by value(A5)	Acting consistently with the new value.

Psychomotor Domain:

Includes physical movement, coordination, and use of the motor-skill areas.

Level	**Definition:**
Imitating (P1)	Attempted copying of a physical behavior
Manipulation(P2)	Reproducing activity from instruction or memory
Precision(P3)	Fine tuning. Making minor adjustments in the physical activity in order to perfect it.
Articulation(P4)	Adapting and integrating expertise to satisfy a non- standard objective

Naturalization(P5)	Automated, unconscious mastery of activity and related skills at strategic level

Knowledge Profile:

Level	Definition:
Natural Sciences(KP1)	A systematic, theory-based understanding of the natural sciences applicable to the discipline
Mathematics(KP2)	Conceptually based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modeling applicable to the discipline
Engineering Fundamentals(KP3)	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
Engineering specialist knowledge(KP4)	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
Engineering Design(KP5)	Knowledge that supports engineering design in a practice area
Engineering practise(KP6)	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
Comprehension(KP7)	Comprehension of the role of engineering in society and of the identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity in economic, social, cultural, environmental and sustainability terms
Research Literature(KP8)	Engagement with selected knowledge in the research literature of the discipline

Range of Complex Engineering Problem Solving:

Level	Definition:
Range of conflicting requirements (CEP1)	Involve wide-ranging or conflicting technical, engineering and other issues
Depth of analysis required (CEP2)	Have no obvious solution and require abstract thinking and originality in analysis to formulate suitable models.
Depth of knowledge required (CEP3)	Require research-based knowledge, much of which is at or informed by the forefront of the professional discipline, that allows a fundamental-based, first-principles analytical approach
Familiarity of issues (CEP4)	Involve infrequently encountered issues
Extent of applicable codes (CEP5)	Are outside the problems encompassed by standards and codes of practice for professional engineering
Extent of stakeholder involvement and level of conflicting requirements (CEP6)	Involve diverse groups of stakeholders with widely varying needs
Consequences (CEP7)	Have significant consequences in a range of contexts
Interdependence (CEP8)	Are high-level problems that include many component parts or sub-problems

Range of Complex Engineering Activities:

Level	Definition:
Range of resources (CEA1)	Involve the use of diverse resources (for this purpose, resources include people, money, equipment, materials, information and technologies)
Level of interaction (CEA2)	Require the resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues

Innovation (CEA3)	Involve the creative use of engineering principles and research-based knowledge in novel ways
Consequences for society and the environment (CEA4)	Have significant consequences in a range of contexts, characterized by their difficulty of prediction and mitigation
Familiarity (CEA5)	Are outside the problems encompassed by standards and codes of practice for professional engineering

BNQF Skill (4 year's Bachelors):

Fundamental Skills:

1. demonstrate knowledge and critical understanding of the well-established principles of his/her field of study, and of the way in which those principles have developed;

2. apply underlying concepts and principles outside the context in which they were first studied, including, where appropriate, the application of those principles in an employment context;

3. apply knowledge and skills in addressing issues/solving problems with minimal supervision;

4. evaluate critically the appropriateness of different approaches to solving problems in his/her field of study;

5. support supervision of junior staff via a mentor or a leader/manager; and

6. display advanced digital literacy which is adequate to perform complex tasks and bring about solutions.

Social Skills:

1. communicate and interact effectively and clearly, ideas, information, problems and solutions as a team to peers, experts and non-experts in Bangla and English;

2. express her/himself fluently and spontaneously in English and Bangla;

3. use language flexibly and effectively for social, academic and professional purposes;

4. produce clear, well structured, detailed text on complex subjects, showing controlled use of organizational patterns, connectors and cohesive devices in advanced proficiency level of Bangla and English;

5. demonstrate the ability to incorporate entrepreneurial skills in planning daily activities; and

6. display advanced civic literacy and knowledge, exercising civic rights and obligations at all levels as well as participating in changes for the improvement of Bangladesh society.

Thinking Skills

1. exercise very substantial degree of autonomy and often significant responsibility in making judgments/ decisions towards the management of self, others and for the allocation of substantial resources; and

2. demonstrate professional knowledge and practical skills in both technical and management to lead a team in inexperienced environment.

Personal Skills

1. engage in self-direction and self-enterprise skills;

2. demonstrate social, professional, environmental and ethical practice/ values;

3. show-case global knowledge and competencies to fulfil employment, entrepreneurial and lifelong learning skills; and contribute significantly to the society.