Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science & Engineering
Mid Examination, Spring 2025
Course Code: CSE115, Course Title: Introduction to Biology and Chemistry for Computation
Level: 01 Term: 01 Batch: 68

Time: 01:30 Hrs **Marks: 25**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	Emma, a biotechnology intern, joins a research lab focused on genetic analysis, eager to explore the molecular foundations of life. On her first day, her supervisor hands her a set of biological samples and says, "Our goal is to study the essential molecules that regulate cellular activities, ensuring growth, development, and survival. One such molecule stores genetic information and plays a crucial role in heredity and protein synthesis. By determining its exact sequence, we can better understand genetic traits, detect mutations, and identify disease-causing variations." Curious, Emma asks, "How do we analyze and read this genetic information?" Her supervisor responds, "To do this, we will first identify the key molecule responsible for storing genetic information and understand its functions. Then, we will apply a widely used sequencing technique to determine the exact order of the genetic code, helping us decode the blueprint of life."		**CO1**
	a)	**Identify** the essential molecule mentioned by Emma's supervisor and **describe** its structure.	**3**
	b)	**Illustrate** the sequencing technique mentioned by Emma's supervisor, including its step-by-step process and significance in genetic research.	**7**
2.	Mr. Rahim is launching a fruit juice company with three branches in Dhanmondi, Gulshan, and Tejgaon. His vision is to provide fresh, high-quality fruit juices while ensuring operational efficiency and sustainable growth. To achieve this, he plans to integrate automated control systems into production and implement advanced scientific methods for quality assurance. To optimize efficiency, he seeks to enhance juice extraction, processing, quality monitoring, and packaging, ensuring a streamlined production process. Additionally, he aims to maintain product purity and comply with chemical industry standards by employing advanced techniques to detect preservatives, artificial additives, sugar levels, and contaminants in fruit juices.		**CO2**
	a)	**Propose** a solution for implementing Mr. Rahim's business plan, ensuring sustainability, operational efficiency and extensibility. **Illustrate** your solution with a proper diagram.	**5**
	b)	**Suggest** a scientific method for maintaining juice quality and discuss its impact. **Examine** how this approach is utilized in the pharmaceutical industry.	**5**
3.	A bioinformatics researcher is investigating the evolutionary similarity between two DNA sequences to identify conserved functional regions. Since the sequences may contain variations such as insertions, deletions, or mutations, the researcher must choose an appropriate alignment strategy to find the most similar subsequence. **Given:** Sequence 1: GATTACA and Sequence 2: GCATGA **Scoring scheme:** Match = +1, Mismatch = 0 and Gap penalty = -2		**CO3**
	a)	**Apply** an appropriate sequence alignment algorithm to determine the most similar subsequence. **Construct** the alignment score matrix and compute the optimal similarity score based on the given scoring criteria.	**5**