

**UNIVERSITY OF BOLTON**

**SCHOOL OF ENGINEERING**

**BENG (HONS) BIOMEDICAL ENGINEERING**

**SEMESTER TWO EXAMINATION 2023/24**

**MOLECULAR AND SYNTHETIC BIOENGINEERING**

**MODULE NO: BME6010**

Date: Wednesday 15<sup>th</sup> May 2024

Time: 2:00pm – 4:30pm

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**INSTRUCTIONS TO CANDIDATES:**

Candidates are advised that the examiners attach importance to legibility of writing and clarity of expression. **YOU ARE STRONGLY ADVISED TO PLAN YOUR ANSWERS.**

There are **FIVE** questions.

Answer **ANY TWO** questions.

All questions carry equal marks.

The examination paper carries a total of 100 marks.

This examination is **TWO** hours and 30 minutes long.

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**Answer TWO from the following five questions.** A total of 100 marks are available.

1. The central dogma theory explains how we can convert a four-letter DNA code into a 20-letter amino acid code. Using at least two detailed examples, explain how mutations in the genetic code can result in non-functioning protein variants.

[50 marks]

2. Define the four main sectors of Biotechnology (**Green, Red, White and Blue**) and suggest how each has used synthetic and molecular bioengineering to answer major societal and/or environmental problems. You should provide specific examples for each sector and be capable of going into molecular detail for the techniques used.

[50 marks]

3. Critically appraise the role of the DBTL (Design, Build, Test and Learn) cycle in the design and production of a DNA circuit. In as much detail as possible, provide examples of techniques and different components used to generate a successful end result.

[50 marks]

4. In as much detail as possible, evaluate how **THREE** of the following techniques can be used to determine the structure of specific biomolecules in molecular biology.

- Mass Spectrometry
- NMR
- X-ray Crystallography
- Cryo-Electron Microscopy

[50 marks]

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5. Molecular cloning is an essential part of synthetic bioengineering, allowing us to create recombinant DNA. In as much detail as possible, design a step-by-step process that would enable you to clone a gene of interest (GOI) into *Escherichia coli* cells.

[50 marks]

[Total 100 marks]

**END OF QUESTIONS**

PAST EXAMINATION