

**CORK INSTITUTE OF TECHNOLOGY**  
**INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

**Autumn Examinations 2014/15**

**Module Title: Introduction to Biotechnology (CA)**

**Module Code:** BIOT6001

**School:** Science and Informatics

**Programme Title:** BSc in Applied Biosciences with Biotechnology  
BSc Hons Pharmaceutical Biotechnology  
BSc Hons in Nutrition and Health Science  
BSc Hons in Analytical and Pharmaceutical Chemistry  
BSc Hons in Analytical Chemistry  
BSc Applied Physics and Instrumentation

**Programme Code:** SBIOS\_7\_Y1  
SPHBI\_8\_Y1  
SNHSC\_8\_Y1  
SCHQA\_8\_Y1  
SCHEM\_7\_Y1  
SPHYS\_7\_Y2

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**Internal Examiner(s):** Dr Helen O'Shea  
Ms Margaret Lane  
Ms Deirdre Ní Bhuachalla

**Instructions:** Answer **question 1** and **3** other questions.

**Duration:** 2 hours

**Sitting:** Autumn 2015

**Requirements for this examination:**

**Note to Candidates:** Please check the Programme Title and the Module Title to ensure that you have received the correct examination paper.  
If in doubt please contact an Invigilator.

### Q1.(COMPULSORY)

- a. What magnification and microscope type is required for viewing the following:
- i. Mammalian cells
  - ii. *E. coli* **(4 marks)**
- b.
- i. What is cryopreservation and what are the typical preservation temperatures for biological cells? **(3 marks)**
  - ii. List three cryoprotectants. **(3 marks)**
  - iii. If frozen cryoprotected bacterial stock is removed from the freezer and allowed to thaw, what percentage of the cells will die? **(2 marks)**
- c. Convert each of the following volumes (shown in mls) to  $\mu\text{l}$ 's and state which micropipette would be most suitable for delivery of this volume. **(6 marks)**

| Volume in ml's | Volume in $\mu\text{l}$ 's | Micropipette |
|----------------|----------------------------|--------------|
| 0.85ml         |                            |              |
| 0.05ml         |                            |              |
| 0.004ml        |                            |              |

- d. Using a diagram show the position of the following fragments of DNA in an agarose gel following electrophoresis and label the positive and negative poles
- i. 134bp
  - ii. 35bp
  - iii. 48bp
  - iv. 90bp
  - v. 64bp **(3 marks)**
- e. Explain why these fragments are in these positions. **(4 marks)**

### ANSWER THREE OF THE FOLLOWING FIVE QUESTIONS

#### Q2.

- a. Discuss with the aid of a labelled diagram a typical fermenter. **(5marks)**
- b. How are each of following controlled in a fermenter. Temperature, pH, oxygen, mixing, sterility. **(10 marks)**
- c. Explain the requirements for each of the following types of organisms
- i. Facultative anaerobic
  - ii. Alkalophile
  - iii. Microaerophilic organisms
  - iv. Psychrophile
  - v. Anaerobic **(10 marks/2 marks each)**

**Q3.**

- Discuss the structure and function of antibodies. **(5 marks)**
- Define monoclonal antibodies **(3 marks)**
- Explain using a diagram how monoclonal antibodies are made. **(11 marks)**
- Describe and give three examples of applications of monoclonal antibodies **(6 marks)**

**Q4.**

- Describe with the aid of a diagram the steps involved in producing recombinant DNA using a plasmid **(8 marks)**
- Define restriction enzymes and give two examples. **(5 marks)**
- Using the following short DNA sequence from the gene which encodes your protein:
  - Write the corresponding mRNA sequence that would be generated in the cell
  - Using the table below, translate the mRNA chain into its corresponding protein sequence **(5 marks)**

DNA sequence:                      TTT    AGC    CAT    GCT    ACC

mRNA sequence                      - - -    - - -    - - -    - - -    - - -

Amino acid sequence                      —    —    —    —    —

| ←                      2nd Base                      → |                    |               |                    |                 |          |
|--|--------------------|---------------|--------------------|-----------------|----------|
| 1st Base   | U                  | C             | A                  | G               | 3rd Base |
| <b>U</b>   | UUU\ phenylalanine | UCU           | UAU\ tyrosine      | UGU\ cysteine   | U        |
|  | UUC/               | UCC serine    | UAC/               | UGC/            | C        |
|  | UUA\ leucine       | UCA           | UAA\ stop          | UGA- stop       | A        |
|  | UUG/               | UCG           | UAG/ stop          | UGG- tryptophan | G        |
| <b>C</b>   | CUU                | CCU           | CAU\ histidine     | CGU             | U        |
|  | CUC leucine        | CCC proline   | CAC/               | CGC arginine    | C        |
|  | CUA                | CCA           | CAA\ glutamine     | CGA             | A        |
|  | CUG                | CCG           | CAG/               | CGG             | G        |
| <b>A</b>   | AUU\ isoleucine    | ACU           | AAU\ asparagine    | AGU\ serine     | U        |
|  | AUC                | ACC threonine | AAC/               | AGC/            | C        |
|  | AUA/               | ACA           | AAA\ lysine        | AGA\ arginine   | A        |
|  | AUG methionine     | ACG           | AAG/               | AGG/            | G        |
| <b>G</b>   | GUU                | GCU           | GAU\ aspartic acid | GGU             | U        |
|  | GUC valine         | GCC alanine   | GAC/               | GGC glycine     | C        |
|  | GUA                | GCA           | GAA\ glutamic acid | GGA             | A        |
|  | GUG                | GCG           | GAG/               | GGG             | G        |

- Explain how you would alter the sequence of amino acids in this protein and give an example of a commercial product where this has been used to improve the product. **(7 marks)**

**Q5.**

- a. List 5 key scientific techniques that have been important in the development of Biotechnology. **(5 marks)**
- b. List five examples of biotechnological products used in the field of medicine. **(5 marks)**
- c. List three types of cells often used to produce Biotechnological products.  
Give an example from each cell type and name a product produced by these cells. **(6 Marks)**
- d. Write brief notes on the significance of any three of the following events associated with the development of Biotechnology.
  - Early observation of cells
  - The discovery of the structure of DNA
  - Growing mammalian cells in a laboratory
  - Processes carried out using 'low technology'
  - Recombinant DNA Technology**(9marks)**

**Q6.**

- (a) Explain what is meant by the term Biopharmaceutical. **(4 marks)**
- (b) Describe the differences between a Biopharmaceutical drug and a Traditional Drug. **(6 marks)**
- (c) Write a descriptive account of the following categories of Biopharmaceuticals.
  - 1. Thrombolytic agents
  - 2. Haematopoietic agents
  - 3. Vaccines**(15 marks/ 5 marks each)**