

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

External Examiner(s): Dr Gillian Gardiner

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 μl 's and state which micropipette would be most suitable for delivery of this volume. **(6 marks)**

Volume in ml's	Volume in μl '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
U	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
C	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
A	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
G	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)**