CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Semester 2 Examinations 2012

Module Title: Introduction to Industrial Biotechnology

Module Code:	BIOT6003
School:	School of Mechanical and Process Engineering
Programme Title:	Higher Certificate in Science in Good Manufacturing Practice – Year 2 BEng (Hons) in Chemical & Biopharmaceutical Engineering – Year 1 Level 8 Engineering Common Entry – Year 1
Programme Code:	SGMPR_6_Y2 ECPEN_8_Y1 EOMNI_8_Y1
External Examiner:	Ms Bernadette Whelan, Dr Stephen Fitzpatrick Mr Richard Cadbury, Dr Gervase McAleavey
Internal Examiner:	Ms Caroline O'Sullivan
Instructions:	**Answer <u>TWO</u> questions from Section A (25 Marks each)** **Answer <u>FOUR</u> questions from Section B (12.5 Marks each)**
Duration:	2 hours
Sitting:	Summer 2012

Requirements for this examination: Calculator

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.

Section A

Q1 Provide an overview of ethanol production under the following headings:

- Fermentation reaction
- Media Design, and
- The Biochemistry

Q2 Table 1 details the results of a batch bioreaction of *Pseudomonas fluorescens* on glucose.

a) Plot X Vs t for this experimental data.

b) Identify the region of exponential growth on this plot.

c) Detail what is happening during the exponential growth.

d) It has been suggested that the following model predicts the relationship between X and t for this bioreaction when

μ_{net} = 0.28 h^{-1}: $$X = X_0 e^{\mu_{net} t}$$

Does this model accurately predict the relationship between X and t? Provide evidence for your answer.

e) Determine the doubling time, t_d.

f) If the preparation time before starting the manufacturing of this is 4 hrs and the harvesting is 3.5 hrs, calculate the time for total batch reaction cycle t_{bc}?

g) Determine $Y_{X/S}$ if ΔS is 25.35 g/L.

Table 1

Time	X
Hours	g/l
0	0.60
2	0.81
4	1.45
6	2.52
8	4.50
10	7.70
12	13.50
14	24.00
16	24.26
18	24.24

Q3 Describe the different types of bio-reactor feeding regimes. What are the advantages and disadvantages of these feeding regimes?

Q4 Provide an overview of the production process for a biopharmaceutical product.

Q5 Illustrate the interrelationships between solids found in wastewater and describe the methods by which they can be measured.

Section B

Q6 EU studies have shown that there is mixed public attitude to the applications of genetic engineering. Outline three of these possible applications and comment on the published public opinion.

Q7 Summarise the effect pH has on bioprocess bio-reactions.

Q8 Explain the difference between the following with the aid of an X and P Vs time curve: Growth Associated Products; Mixed Growth Associated Products and Non Growth Associated Products.

Q9 Explain the meaning of all of the terms in the following equation:

$$OTR = k_L a\left(C^* - C_L\right)$$

Q10 Describe the expression of therapeutic proteins in ecoli and cite advantages and disadvantages of this expression system.

Q11 Outline the three categories of biotechnology products produced by living organisms, provide some examples.

Q12 Describe with the aid of a diagram the transfer of oxygen from an air bubble into a cell or a clump of cells.

Q13 Outline the main design considerations when constructing an activating sludge treatment plant.