UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For the following qualifications :-

B.Eng. *B.Sc.* *M.Eng.*

Biochemical Eng E100: Introduction to Biochemical Engineering

COURSE CODE	:	**BENGE100**
UNIT VALUE	:	**0.50**
DATE	:	**10-MAY-02**
TIME	:	**14.30**
TIME ALLOWED	:	**2 hours**

TURN OVER

UNIVERSITY OF LONDON

Biochemical Engineering

E100

Introduction to Biochemical Engineering

*Answer **THREE** questions.*
Marks distributed as shown [ ]

1. a) Outline the advantages of biocatalyst immobilisation and describe the principles behind each of the main immobilisation techniques. [15]

b) With reference to a particular industrial process describe the factors influencing the choice of immobilisation technique and support material. [10]

2. a) Describe the operating principle of polarographic electrodes and their use for the measurement of dissolved oxygen concentrations in fermentation broths. [9]

b) Describe, in detail, a method for the quantification of oxygen mass transfer coefficients in a stirred tank fermenter. Clearly state any assumptions made. [11]

c) Briefly explain how the design and operation of the fermenter will influence the measured oxygen mass transfer coefficient. [5]

3. a) The maximum specific growth rate (μ_{max}) for a microorganism grown in batch culture in complex media is 1.7 h^{-1}. Calculate the doubling time (t_d) for the microorganism under such conditions. Give typical t_d values for bacteria and mammalian cells in culture. [10]

b) Describe the various modes of operation of cell culture processes. [7]

c) Describe the various patterns of growth and product formation for cultured microorganisms. Explain why this information is important for process design. [8]

TURN OVER

4. Given the following general stoichiometric equation for the growth of a microorganism in culture:

$$aC_6H_{12}O_6 + bO_2 + cNH_3 \rightarrow dC_6H_{10}O_3N_2 + eCO_2 + fH_2O$$

a) Write down the elemental mass balances. Clearly state any assumptions made. [8]

b) Under the conditions used the yield of biomass on substrate is typically 0.4 (on a mass basis). Considering 3000 litres of medium with a biomass concentration of 5g/l and an ash content of 3.8% (w/w), calculate the amount (in kg) of glucose and ammonia that were required. [9]

c) Define respiratory quotient (RQ). What process parameters would you use to calculate RQ? [8]

Atomic weights: H=1; C=12; N=14; O=16

5. Recent developments in molecular genetics and diagnostics are set to have a major impact on human health care. For each of the following briefly outline the basis of the technology and describe the factors that need to be considered before implementation.

a) The production of human therapeutic antibodies in plants. [13]

b) The screening of humans for genetic diseases. [12]

END OF PAPER