

# Cork Institute of Technology

## Bachelor of Science in Applied Biosciences – Stage 1

(SBIOS\_7\_Y1)

Summer 2008

### Mathematics & Computing – Old Syllabus

(Time: 3 Hours)

#### Instructions

Answer **FIVE** questions.

Answer **FOUR** questions from Section A and **ONE** question from Section B.

Use separate answer books for each Section.

All questions carry equal marks.

Examiners: Ms. I. Foley

Ms. H. Lordan

Dr. P. Robinson

#### Section A

Q1. (a) Using the laws of indices

(i) Simplify: 
$$\sqrt[3]{\frac{27a^5bc^{-8}}{64a^{-4}b^4c^4}}$$

(ii) Solve for  $x$ :  $9^{2x-3} = 3^{x+2} \times 27^{2-x}$

(6 marks)

(b) Solve for  $x$  in each of the following:

(i)  $\log(x-1) + \log(2x+3) = 1$

(ii)  $3^{5x+1} = 7^{1-x}$ .

(iii)  $\log_3 7 = x$ .

(8 marks)

(c) (i) Transpose the formula  $V_0 = \frac{A}{\sqrt{1 - \frac{v^2}{k^2}}}$  to make  $k$  the subject.

(ii) Calculate the value of  $k$  when

$V_0 = 1.45 \times 10^4$ ,  $A = 4.92 \times 10^3$ ,  $v = 2.06 \times 10^{-3}$ . (6 marks)

- Q2 (a) Draw graphs of  $Y_1 = 3e^{0.3x}$  and  $Y_2 = 5e^{-0.2x}$  on the same axes, for values of  $x$  between 0 and 3 using intervals of 0.5. Hence or otherwise solve the equation  $3e^{0.3x} = 5e^{-0.2x}$ .
- (8 marks)

- (b) The size ( $N$ ) of a certain culture of bacteria after  $t$  days is given by  $N = Ae^{kt}$  where  $A$  and  $k$  are constants. If  $A = 580$  and  $k = 0.55$ , find:
- (i)  $N$  when  $t = 3$ ,
- (ii)  $t$  when  $N = 8,500$
- (7 marks)

- (c) Solve for  $x$ :  $9e^{2x} - 36e^x = 108$ .
- (5 marks)

- Q3 (a) Express each of the following equations in linear form ( $y = mx + c$ ), indicating what you would plot on each axis and how each constant may be evaluated:

(i)  $PV^n = C$   $n$  and  $C$  are constants

(ii)  $C = \frac{T}{A + kT}$   $A$  and  $k$  are constants

(iii)  $R = ae^{bT}$   $a$  and  $b$  are constants.

(9 marks)

- (b) In an experiment carried out on two variables  $L$  and  $W$  were found to have the following values:

W	33.2	27.4	18.6	9.4	5.5
L	0.741	0.233	0.116	0.076	0.067

Show by plotting  $W$  against  $\frac{1}{L}$  that they are related by the law

$$W = \frac{a}{L} + b \text{ and find approximate values for } a \text{ and } b.$$

(11 marks)

- Q4 (a) Show that  $x = -1$  is a root of the cubic equation  $x^3 - 10x^2 + 17x + 28 = 0$ .  
Use the remainder theorem to find the other two roots.

(8 marks)

- (b) Given side  $a = 3.8\text{m}$ , side  $b = 3.65\text{m}$  and angle  $A = 72^\circ$ , solve the triangle.

(6 marks)

- (c) Solve the equation:  $4\sin(A - 30^\circ) = 3$  giving all solutions in the range  $0^\circ$  to  $360^\circ$ .

(6 marks)

- Q5 The following table gives data that was obtained during an experiment:

$x$	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29
$f$	1	14	23	21	15	6

- (a) Taking the mid-interval values, calculate the mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) from the mean.

(8 marks)

- (b) Represent information on a histogram.

(5 marks)

- (c) From the histogram, estimate the median and the mode.

(3 marks)

- (d) What percentage of data was greater than 23?

(4 marks)

$$\text{Mean } \bar{x} = \frac{\sum fx}{\sum f} \quad \text{Standard Deviation } \sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{\sum f}}$$

Q6 (a) Differentiate from first principles:  $y = 3x^2 - 4x$ . (5 marks)

(b) Differentiate each of the following with respect to the variable:

(i)  $4\sqrt{x^5} + 3x^4 - \sin(7x) + 10 - \frac{1}{3x^2}$

(ii)  $(x+5)^3 \sqrt{2x^2 - 3x}$

(iii)  $\frac{2e^{-5x}}{(3x-7)}$

(9 marks)

(c) Find the maximum and minimum values of  $y = x^3 - 3x^2 - 9x + 4$ . Use differentiation to distinguish between them. Sketch the curve.

(6 marks)

7 (a) Determine any **three** of the following integrals:

(i)  $\int (4x^{-5} + 3\sqrt{x} + \sin 5x - 6e^{-2x}) dx$

(ii)  $\int_2^4 (2x-5)^2 dx$

(iii)  $\int \frac{4x^5 - x^7 + 2x^4}{x^6} dx$

(iv)  $\int_0^3 (3x^2 - 4x)^2 (6x - 4) dx$

(12 marks)

(b) Find the area enclosed by the curve  $y = 2x^2 - 3x$ , the  $x$ -axis and the ordinates  $x = 2$  and  $x = 5$ . Sketch the curve.

(8 marks)

## Section B

### Answer Q8 or Q9

Q8 (a) Explain four of the following terms:

- i. URL
- ii. Peripherals
- iii. System Software
- iv. WWW
- v. Kernel
- vi. Primary Storage

(8 marks)

(b) What is the CPU? Name two of the main components of a CPU and list their main functions.

(6 marks)

(c) What is a Cold Boot? List the six steps involved in a Cold Boot.

(6 marks)

Q9. (a) Explain four of the following terms:

- i. ROM
- ii. Computer Virus
- iii. Solid State Storage Devices
- iv. RAM
- v. System Requirements
- vi. Shareware

(8 marks)

(b) What is the Internet? What is the difference between the Internet and the World Wide Web? What are the essential items you need to access the Internet and Web?

(6 marks)

(c) What is a computer network? List the advantages and disadvantages of networks.

(6 marks)