

Cork Institute of Technology

Higher Certificate in Science in Applied Biology – Stage 1

(NFQ Level 6)

Autumn 2006

Mathematics & Computing

(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: Dr. K. Murphy

Ms. I. Foley

Ms. H. Lordan

Mr. D. O'Shea

SECTION A

Q1 (a) Using the laws of indices, simplify

(i) $\sqrt{\frac{8x^2yz^5}{2yz^2}} \times \frac{3x}{z^{-1}}.$

(ii) $\frac{9}{\sqrt{36^{-n}}} \times \frac{128}{24^{n+1}}.$

(7 marks)

(b) Solve for x :

(i) $\log(8-x) = 2 \log 3 + 2 \log x$

(ii) $\log_2 x - \log_2(x-2) = 4.$

(iii) $3 \log_x 8 = 2.$

(7 marks)

(c) (i) Transpose the formula $s = \sqrt{\frac{t-q}{t+2q}}$ to make t the subject.

(ii) Calculate the value of t when $q = 2 \times 10^4$, $s = 1.4 \times 10^{-1}.$

(6 marks)

- Q2 (a) Graph $y = 3e^{-0.2t}$ from $t = 0$ to $t = 7$ using intervals of one unit. From the graph find
- t when $y = 1.3$ and
 - y when $t = 1.7$.
- (6 marks)
- (b) By use of the remainder theorem, solve the equation $x^3 + 6x^2 + 11x + 6 = 0$.
- (8 marks)
- (c) The roots of a quadratic equation are -3 and 0.5 . Write down the factors and hence the quadratic equation in its simplest form.
- (6 marks)

- Q3 (a) Write each of the following in linear form where a and b are constants in all cases:
- $y = ax + \frac{b}{x}$
 - $y = ab^x$
 - $y = \frac{x^2}{ax + bx^2}$
- (9 marks)
- (b) The following table gives values of x and y which are believed to be related by the law $y = ae^{wx}$ where a and w are constants.

x	0.25	0.9	2.1	2.8	3.7	4.8
y	6	10	25	42.5	85	198

Verify the law is as stated. Find approximate values for a and w , and hence state the law.

(11 marks)

Q4 (a) Solve for θ in each of the following equations, if $0^\circ \leq \theta \leq 360^\circ$

(i) $3 \cos(\theta - 20^\circ) = 2.5$

(ii) $5 \sin^2 \theta - 3 \sin \theta - 2 = 0$ (7 marks)

(b) In a triangle ABC, $b = 17$ mm, $c = 21$ mm and $C = 82^\circ$. Find the size of the other two angles in this triangle.

(5 marks)

(c) (i) Sketch the curve $y = 12 \sin(3x - 30^\circ)$ over one complete cycle. Indicate the amplitude, period and phase angle.

(ii) Convert 3.258 radians to degrees and minutes. (8 marks)

Q5 The heights of 50 students were recorded to the nearest cm and recorded as follows:

Height (cm)	160-164	165-169	170-174	175-179	180-184	185-189
Number of Students	5	8	11	14	7	5

(a) Taking the mid-interval value calculate the mean (\bar{x}) and standard deviation (σ) from the mean. (8marks)

(b) Represent the information on a histogram. (6marks)

(c) From the histogram read off the mode and the median. (4marks)

Q6 (a) Differentiate from first principles: $f(x) = x^2 - 5$ (5 marks)

(b) Differentiate each of the following:

(i) $f(x) = \frac{3}{2x^2} - 17x + e^{3x} - \sin x$

(ii) $f(x) = \frac{x^2 - 4x}{\sqrt{3x - 10}}$

(iii) $y = e^{-5x} \cos 2x$

(9 marks)

(c) A bacteria culture undergoes a period of growth and decay before it develops into a steady growth. If the number of bacteria y in the culture is given by $y = t^3 - 8t^2 + 13t + 21$ with t in hours.

(i) Find the values of t for which the early maximum and minimum populations occur.

(ii) Calculate the populations at these two times.

(6 marks)

Q7 (a) Determine each of the following:

(i) $\int (8x^5 - \frac{3}{2x^4} - 10\sqrt{x} - 3e^{-3x} + 2)dx$

(ii) $\int_{\frac{\pi}{5}}^{\frac{\pi}{4}} 12 \sin 3x dx$

(iii) $\int (5x + 6)^2 dx$

(iv) $\int (3x^3 + 3x^2)^2 (9x^2 + 6x) dx$ (14 marks)

(b) If $\frac{dy}{dx} = 9x^2 - 6x - 10$, find y in terms of x given that $x = 2$ when $y = 5$.

(6 marks)

Section B

Answer Q8 or Q9

Q8 (a) What is a CPU? Name two of the main components of the CPU and explain what their functions are. Give two measures of performance that can be used to evaluate a CPU. (8 marks)

(b) Explain 3 of the following terms:

ROM;

LAN;

Hard Disk;

Input Devices;

Multitasking.

(6 marks)

(c) What is an operating system? What are the functions of an operating system?

Give three examples of operating systems currently in use today. (6 marks)

Q9 (a) In order to access the Internet, what do you need in terms of computer hardware and software? Given the following URL, identify and explain each of the parts: <http://www.rte.ie/2fm/charts/singles.html> (8 marks)

(b) Explain 3 of the following terms:

Byte;

Warm Boot;

Peripheral Devices;

RAM;

Web Browser.

(6 marks)

(c) What is a Secondary Storage Device? Name two categories of Secondary Storage Devices, and give an example of each. What steps can a person take to protect data saved on CDs and/or DVDs. (6 marks)