

**CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ**

Autumn Examinations 2007/08

**Module Title: Technological Mathematics 1
Technological Mathematics 1 (C.A.)**

Module Code: **MATH 6013 : MATH 6016**

School: School of Science

Programme Title:

B.Sc. in Applied Biosciences – Year 1

B.Sc. in Analytical & Pharmaceutical Chemistry – Year 1

B.Sc. in Applied Physics & Instrumentation – Year 1

B.Sc (Hons) in Computerised Instrument Systems – Year 1

Higher Certificate in Industrial Measurement and Control – Year 1

Programme Code:

SBIOS_7_Y1

SCHEM_7_Y1

CR_SPHYS_7_Y1

CR_SCISY_8_Y1

SIMTC_6_Y1

External Examiner(s): **Dr. P. Robinson**

Internal Examiner(s): **Ms. H. Lordan, Ms. F. Wood,
Ms. M. Harley, Mr. G. O'Driscoll**

Instructions: **Answer QUESTION 1 (worth 30 points) and
TWO other questions (worth 35 points each)**

Duration: **2 HOURS**

Sitting: Autumn 2008

Requirements for this examination: Mathematics Tables

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you are attempting the correct examination.
If in doubt please contact an Invigilator.

Q.1

- (i) Evaluate $P = \sqrt{\frac{16}{\pi f} \left(M + \sqrt{M^2 + T^2} \right)}$ given that $f = 8400$, $M = 12560$, $T = 25000$.

Give your answer correct to 3 d.p.

(5 marks)

- (ii) Transpose the following formula to make b the subject

$$a = \frac{x - y}{\sqrt{bd + be}}$$

(5 marks)

- (iii) The voltage in a circuit is given by $V = 20e^{-400t}$ where t is the time.
Evaluate (a) V when $t = 4.3 \times 10^{-3}$ (b) t when $V = 8$.

(5 marks)

- (iv) For the following, state the variables you would plot to obtain a linear graph.
In each case state the slope of the line and intercept on the vertical axis.

(a) $L = ae^{bt}$ (b) $\frac{1}{L} = at^2 + b$

(5 marks)

- (v) The current i flowing in a circuit at any time t seconds is given by
 $i = 100\sin(100\pi t + 0.2)$ mA
Find the time t when the current first reaches (a) 80 mA (b) a maximum.

(5 marks)

- (vi) $s = ut + \frac{1}{2}at^2$. Determine the constants u and a given that
 $s = 42$ when $t = 2$ and $s = 144$ when $t = 4$

(5 marks)

Q.2(a) Simplify $\frac{6^{3x+4}}{27^{x+1} \times 8^{x+2}}$ (6 marks)

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

(i) $\log_2(3x-1) - \log_2(x-2) = 3$

(ii) $6^t \cdot 3^{2t} = 9^{3t-1}$

(13 marks)

(c) Transpose the equation $S = W \left(L^2 + \frac{1}{a^2} \right)$ to make a the subject.

(6 marks)

(d) The total surface area of a closed cylinder is 165 cm^2 . Given that the total surface area is $A = 2\pi r^2 + 2\pi rh$ calculate the radius if the height is 9.65 cm .

(10 marks)

Q.3(a) Express each of the following equations in linear form, indicating what you would plot on each axis and how each constant may be evaluated:

(i) $y = ax^b$ a and b are constants

(ii) $y = \frac{r}{x} + sx$ r and s are constants. (12 marks)

(b) The law $V = at^2 + bt$ is thought to apply to the data below, where a and b are constants.

V	4.5	38.5	121.4	231.8	318.3
t	0.5	2.6	5.3	7.7	9.2

Verify this law applies by plotting a graph of $\frac{V}{t}$ against t values.

Use your graph to determine the constants a and b .

(23 marks)

Q.4(a) State the amplitude, periodic time, phase and time displacement for the wave function $i = 120 \sin(50\pi t - 0.6)$. Hence sketch one cycle of the wave function.

Find the time in the first cycle when $i = 100$.

(15 marks)

(b) Express $10 \sin t + 7 \cos t$ as a single wave function of the form $r \sin(t + \alpha)$.

Hence find a solution for t in the equation $10 \sin t + 7 \cos t = 5$.

(12 marks)

(c) Find a solution to the equation $12 \cos A - 7 \sin^2 A = -3$.

(8 marks)

Trigonometric Identity:

$$\sin^2 A + \cos^2 A = 1$$