CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2017/2018

Module Title: Technological Mathematics 1

Module Code: MATH 6014

School: School of Mechanical, Electrical & Process Engineering.
School of Biomedical Engineering.

Programme Title:

Bachelor of Engineering (Hons) in Sustainable Energy Engineering – Year 1
Bachelor of Engineering in Electronic Engineering– Year 1
Bachelor of Engineering (Hons) in Electronic Engineering– Year 1
Bachelor of Engineering in Electrical Engineering – Year 1
Bachelor of Engineering (Hons) in Electrical Engineering – Year 1
Bachelor of Engineering in Mechanical Engineering – Year 1
Bachelor of Engineering in Biomedical Engineering – Year 1

Programme Code:

ESENT_8_Y1 EELXE_7_Y1 EEPSY_8_Y1 EELEC_7_Y1

EELES_8_Y1 EMECH_7_Y1 EBIME_7_Y1

External Examiner: **Dr. J. Cruickshank.**

Internal Examiners: **Ms. K. Bullen, Ms.H.Lordan, Dr. M. Nicholson, Mr. D. O'Shea, Dr. C. Palmer.**

Instructions: Answer ALL Four questions

Duration: 2 HOURS

Sitting: Autumn 2018

Requirements for this examination: Graph paper, Formulae & Tables Book

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

1.

a.

i. Express $\sqrt{9x^3}$ in index form.

ii. Simplify the following expression using the laws of indices. Write your answer using positive indices only.

$$\frac{(a^{-2}b)^5c^3}{\sqrt{b^{-4}c^5a^2}}$$

iii. Solve for x:

$$4^{2x-1}32^{1-x} = 2^x$$

[8 marks]

b. Solve the following equations:

i. $2^{3x+1} = 5$

ii. $\ln(x^2 + x) - \ln(x + 1) = \ln(5x - 3)$

iii. Simplify the following **without using a calculator**, giving your answer as a single logarithmic term:

$$2\log_4 3 + \frac{1}{3}\log_4 8 - \log_4 6$$

[10 marks]

c.

Given the formula:

$$s = \sqrt{\frac{t}{s} + \frac{st}{p}}$$

i. Transpose the formula to make p the subject.

ii. Evaluate s correct to two decimal places given $t = 2.9 \times 10^3$, $p = 9.3$ and $s = 3.35 \times 10^{-1}$.

[7 marks]

2.

a. Resolve $\frac{7x-22}{(2x-5)(4-x)}$ into its partial fractions.

[8 marks]

b. Solve the following simultaneous equations:

$$\frac{x}{7}+\frac{y}{5}=\frac{10}{7}$$
$$x+\frac{y}{3}=\frac{14}{3}$$

[7 marks]

c. i. Show that $x = 2$ is a root of the polynomial:

$$f(x) = 2x^3 - 3x^2 - 6x + 8$$

and determine the other two roots.

ii. Draw a rough sketch of $f(x) = 2x^3 - 3x^2 - 6x + 8$ for $-2 \leq x \leq 3$, indicating clearly the x and y intercepts.

[10 marks]

3.

a. L is the line $x - 3y + 4 = 0$

i Write down the slope of the line L

ii. Find the equation of the line parallel to L that passes through the point $(3, -4)$.

[7 marks]

b. Write each of the following in linear form, indicating clearly what would be plotted on each axis and what each constant represents.

i. $Y = a Z^3 + \frac{b}{Z^2}$, where *a* and *b* are constants.

ii. $Q = a P^b$, where *a* and *b* are constants.

[8 marks]

c. The current *i* amps flowing in a capacitor at time t seconds is given the formula: $i = 50(1 - e^{\frac{-5t}{8}})$

i. Find the value of *i* when *t* = 80 milliseconds, correct to two decimal places.

ii. Find the value of *t* when *i* = 24 amps.

[10 marks]

4.

a. Let A be an angle In a right angled triangle with cos(A) = $\frac{3}{7}$. Express sin(A) and tan(A) in the form $\frac{\sqrt{m}}{n}$ where m and n are integers.

[3 marks]

b. i. Find all the values of $0 \leq \theta < 2\pi$ that satisfy the following equation:

$$cos(\theta) = -0.788$$

ii. Find all the values of $0^o \leq \theta < 360^o$ that satisfy the following equation:

$$\sqrt{3}tan(2\theta - 15^o) = 3$$

[7 marks]

c. The current in an a.c. circuit at any time t seconds is given by

$$i = 120 \sin(100\pi t + 0.36) \text{ amperes.}$$

Find:

i. The amplitude, the periodic time, the frequency and phase time (horizontal shift).

ii. The current when $t = 0$.

iii. The current when $t = 0.004$ seconds.

iv. The time when the current is first a maximum.

v. Sketch the curve for one cycle showing relevant points

[15 marks]