CORK INSTITUTE OF TECHNOLOGY

INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2017/18

Module Title: Technological Maths 220

Module Code: MATH 6041

School: School of Electronic Engineering

School of Electrical Engineering

Programme Title: Bachelor of Engineering in Electronic Engineering – Year 2

Bachelor of Engineering in Electrical Engineering – Year 2

Bachelor of Engineering in Electrical Power Systems – Year 2

Bachelor of Engineering in Communications Systems – Year 2

Programme Code:

EEXE_7_Y2	EELES_8_Y2
IE2_8_Y2	EELEC_7_Y2
EELES_8_Y2	EEPSY_8_Y2

External Examiner: **Dr. James Cruickshank**

Internal Examiners: **Ms. J.English**

Instructions: **Answer 3 Questions. ALL questions carry equal marks**

(Total Marks = 90)

Duration: **2 HOURS**

Sitting: Autumn 2018

Requirements for this examination: Mathematics Tables, graph paper.

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.

Q1. (a) The resistance in $k\Omega$ of a sample of resistors was measured and the results are shown below.

Resistance ($k\Omega$)			No. of Resistors
88	but less than	92	6
92	but less than	96	19
96	but less than	98	21
98	but less than	100	29
100	but less than	102	25
102	but less than	106	24
106	but less than	112	16

(i) Calculate the mean ($\overline{x}$) and standard deviation $\left(s\right)$ of the sample correct to 2 decimal places. [10]

(ii) Establish a cumulative frequency table and hence plot the cumulative frequency curve for this data set. [7]

(iii) Use your graph to estimate the number of resistors in the range $\overline{x} \pm s$. [5]

Q1 (b) Determine the five number summary for the data set below. Create a boxplot for this data. Comment on the result.

30, 31, 44, 62, 46, 49, 40, 54, 62, 41, 58, 41, 56, 51 [8]

Q2 (a) A curve is represented in parametric form by $x = 4t$, $y = t^3 - 12t$. Find

(i) $\frac{dy}{dx}$ for the function at the point (4,-11)

(ii) $\frac{d^2y}{dx^2}$ at this point also.

[10]

Q2 (b) If $m = 5x^3y^2 - 3x^2 + 8y^3$, find (i) $\frac{\partial m}{\partial x}$ (ii) $\frac{\partial m}{\partial y}$ (iii) $\frac{\partial^2 m}{\partial y \partial x}$

[10]

Q2 (c) Show that the equation $x^3 - 3x - 5 = 0$ has a root in the interval $\left[2,3\right]$. Use three iterations of the Newton-Raphson method to find the root correct to three decimal places. [10]

Q3 (a) A gas is being pumped into a spherical balloon at the rate of $0.4\text{m}^3\text{s}^{-1}$. Find the rate of change of the surface area of the balloon at the instant when the radius is 3m. [10]

Q3 (b) Given a curve described by the equation

$$4x^3+3y^3-3xy^2-2x=14,$$

(i) show that the point (1,2) is on the curve.

(ii) find $\frac{dy}{dx}$ for the function at any point and in particular at the point (1,2).

[10]

Q3 (c) Given that $T=\sqrt{\frac{L^4}{g^3}}$ where L and g are variables, use differentials to find the approximate percentage change in T if L increases by 2.75% and g decreases by 1.8%. [10]

Q4. (a) Evaluate each of the following integrals:

(i) $\int_0^{\frac{\pi}{3}} 2x\sin(3x)dx$

(ii) $\int \frac{5x-11}{(x-4)(2x-5)}dx$

(iii) $\int \frac{2}{\sqrt{14-x^2+6x}}dx$

[17]

Q4. (b) (i) Plot the graph $y=x^2+3$ for values of x in the range [1,3].

(ii) Determine the area bounded by the curve in part (i) and the x axis by integration.

(iii) Find the mean and the r.m.s. values over the same range. [13]