

INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES*

FINAL
Examination Paper
(COVER PAGE)

Session : January 2014

Programme : Diploma in Electrical and Electronic Engineering (DEEI)

Course : **MAT 1122: Engineering Mathematics 2**

Date of Examination : _____

Time : _____ Reading Time : Nil

Duration : 2 Hours

Special Instructions : _____

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-programmable calculator

Materials provided :

Formula Booklet 1

Examiner(s) :

Chan Ah Wah

Moderator :

This paper consists of 4 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG
 DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (DEEI)
 MAT1122 ENGINEERING MATHEMATICS 2
 FINAL EXAMINATION : JANUARY 2014 SESSION

Instructions

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Question 1

(a) Let $z = (1 + i\sqrt{2})^2 - (1 - i\sqrt{2})^2$.

(i) Express z in the form $a + ib$ where a and b are real numbers .

[2 marks]

(ii) Use De Moivre's theorem to find z^4 . Leave your answer in Cartesian form .

[3 marks]

(b) Solve the equation $z^3 - 1 = i$ for z . Let your answers be in the form $a + bi$ and correct to 4 decimal places .

[6 marks]

(c) Given that $A = \begin{bmatrix} x-3 & 5 \\ 2-x & 2 \end{bmatrix}$ and $|A| = 12$, find the value of x . Hence, determine A^2 and A^T .

[4 marks]

(d) Find the inverse of the following matrix by using elementary row operations :

$$A = \begin{bmatrix} -2 & -3 & 4 \\ 2 & 2 & -3 \\ 1 & 2 & -1 \end{bmatrix}$$

[10 marks]

Question 2

(a) Determine the following integrals :

(i) $\int x^2 \sin 3x \, dx$

[4 marks]

(ii) $\int \frac{x^2 + 5x + 2}{x^3 + x^2} \, dx$

[6 marks]

(iii) $\int \sqrt{9 - x^2} dx$

[5 marks]

(iv) $\int \frac{(1 + e^x)^2}{1 + e^{2x}} dx$

[5 marks]

- (b) Use Euler's method to solve for the values of
- y
- for
- $x = 1$
- (
- -0.2
-)
- 0.4
- if

$$x \frac{dy}{dx} + y(x - 1) = 0, \quad y(1) = 12.$$

Let all workings be correct to **three (3)** decimal places .

[5 marks]

Question 3

- (a) Given that
- $z = y^2 e^{xy} - e^y$
- , find
- $\frac{\partial z}{\partial y}$
- ,
- $\frac{\partial^2 z}{\partial y^2}$
- and
- $\frac{\partial^2 z}{\partial x \partial y}$
- .

[6 marks]

- (b) The dimensions of a closed rectangular box are measured as 80cm, 60cm and 50cm, with the possible error of 0.2cm in each dimension. Estimate the maximum possible error of calculating the surface area of the box.

[6 marks]

- (c) The voltage
- V
- in a circuit that satisfies
- $V = IR$
- is decreasing at the rate of 0.01 volt/sec. At the same time, the resistance
- R
- is increasing at the rate of 0.5 ohm/sec. Find the rate of change of the current when
- $R = 600$
- ohm, and
- $I = 0.04$
- amp.

[5 marks]

- (d) From the Maclaurin series for the function
- $\cos x$
- , deduce the expansions of the functions
- $\cos 2x$
- and
- $\sin^2 x$
- as far as the term in
- x^4
- .

[4 marks]

- (e) Evaluate
- $\lim_{x \rightarrow 0} \left[\frac{e^x - 1}{x^2} - \frac{1}{x} \right]$
- by series expansion. Refer to the Formula Booklet where necessary.

[4 marks]

Question 4

- (a) A certain chemical substance dissolves in water at a rate given by
- $\frac{dx}{dt} = kx$
- where
- x
- is the amount dissolved at time
- t
- . If the substance starts with the amount of 20 grams and left with 8 grams after 2 hours, find the amount left after 6 hours.

[5 marks]

(b) Solve the following differential equations :

(i) $2x \frac{dy}{dx} = 1 - 2y + y^2$, given that $y = 0$ when $x = e$.

[6 marks]

(ii) $\frac{dy}{dx} + \frac{y}{x} = 2 \sin x$, given that $y = 1$ when $x = \pi$.

[7 marks]

(iii) $2 \frac{d^2y}{dx^2} + \frac{dy}{dx} - 3y = \frac{1}{2}x^2$.

[7 marks]

Question 5

(a) Use Laplace transform to solve the following differential equation :

$$\frac{d^2y}{dt^2} = e^t \sin 2t; \quad y(0) = 1, \quad y'(0) = -1.$$

[12 marks]

(b) The temperature distribution of 50 cities is shown in the table below :

Temperature(°C)	Number of cities
10–14	11
15–19	10
20–24	17
25–29	8
30–34	4

Determine the mean, standard deviation and mode of the temperature of the 50 cities .

[7 marks]

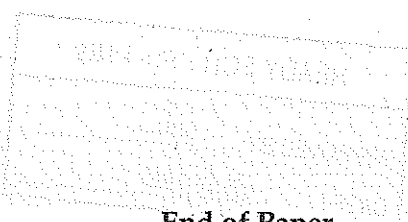
(c) The reading time of a child is normally distributed with mean of 30 minutes and standard deviation of 5 minutes . Find the probability that the reading time of the child is

(i) between 27 and 33 minutes,

[3 marks]

(ii) not less than 25 minutes .

[3 marks]



End of Paper

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