INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2017**
Programme	:	Diploma in Electrical and Electronic Engineering (DEEI)
Course	:	**MAT 1135: Engineering Mathematics 2**
Date of Examination	:	15 December 2017 (Friday)
Time	:	8:00am – 10:00am 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	:	Dr. Ch'ng Pei Eng

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

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEE/I)
MAT1135 ENGINEERING MATHEMATICS 2

FINAL EXAM : AUGUST 2017 SESSION

Instructions

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

Question 1

(a) If $z_1 = -2 + 3i$ and $z_2 = 3 - 5i$, compute $\dfrac{z_1}{z_1 + z_2}$ and leave your answer in Cartesian form.

[5 marks]

(b) Given $z = -3 + 4i$.

(i) Express z in polar form, with argument in degrees.

[4 marks]

(ii) Find the square roots of z. Leave your answers in polar form.

[6 marks]

(c) A storage tank used to hold sand is leaking. The sand forms a conical pile whose height is twice the radius of the base. The radius of the pile increases at the rate of 3 inches per minute. Find the rate of change of volume when the radius is 7 inches. Leave your answer in terms of π.

[10 marks]

Question 2

(a) Solve the following:

(i) $\displaystyle\int \frac{\sec^2 x}{\sqrt{1 - \tan^2 x}}\, dx$; use $u = \tan x$

[4 marks]

(ii) $\displaystyle\int \frac{\ln x}{x}\, dx$; use $u = \ln x$

[4 marks]

(iii) $\displaystyle\int \frac{x + 1}{\sqrt{x^2 + 2x + 3}}\, dx$; use $u = x^2 + 2x + 3$

[4 marks]

(b) Derive, from first principles, the Maclaurin seires of $\tan x$ up to the term in x^3.

[7 marks]

(c) Given $z = \sqrt{\frac{3x}{y}}$. Evaluate $\frac{\partial^2 z}{\partial x^2}$ when $x = \frac{1}{2}$ and $y = 3$.

[6 marks]

Question 3

(a) Solve the following first order differential equations:

(i) $(1 + x^2)\frac{dy}{dx} + 3xy = 5x$

[8 marks]

(ii) $\frac{dy}{dx} + (\tan x)\, y = \sin x$

[7 marks]

(b) Solve the following second order homogeneous differential equations:

(i) $2\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 3y = 0$

[3 marks]

(ii) $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 16y = 0$

[3 marks]

(c) Use Euler's method to solve for the values of y for $x = 0.0(0.1)0.4$ if

$$\frac{dy}{dx} = y^2(1 + 2x), \quad y(0) = 1.$$

Let all workings be correct to **four (4)** decimal places. The formula for Euler's method is as follows:

$$\frac{dy}{dx} = f(x,y); \;\; x_{n+1} = x_n + h; \;\; y_{n+1} = y_n + hf(x_n, y_n)$$

[4 marks]

Question 4

(a) Solve the second order differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 2x^2$ using the method of undetermined coefficients.

[11 marks]

(b) Use Laplace transfom to solve the following differential equation:

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = \sin 2t$$

given that $y(0) = 0$ and $y'(0) = 0$.

[14 marks]

Question 5

(a) The table below shows the weekly wages of 300 employees of a manufacturing company.

Weekly wage (RM)	50 – 59	60 – 69	70 – 79	80 – 89	90 – 99
No. of employees	5	35	114	87	59

Determine, correct to 2 decimal places, and using SD mode in calculator if necessary, the following:

(i) mean,

[2 marks]

(ii) mode,

[4 marks]

(iii) median,

[4 marks]

(iv) standard deviation (σ).

[2 marks]

(b) A machine in the production line of a factory typically produces 10% of its components outside the tolerance required. In a random sample of 10 components produced by this machine, determine, correct to 4 decimal places, the probabilities of having exactly three (3) components outside the required tolerance by assuming

(i) a binomial distribution,

[3 marks]

(ii) a Poisson distribution.

[3 marks]

(c) If the diameters of a particular type of ball bearings are normally distributed with mean 15.6 mm and standard deviation 0.06 mm, determine the percentage (correct to 2 decimal places) of ball bearings with diameters

(i) less than 15.5 mm,

[3 marks]

(ii) between 15.5 mm and 15.7 mm.

[4 marks]

End of Paper

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