



**INTI**  
International College Penang

**FINAL**  
Examination Paper

(COVER PAGE)

Session : August 2018

Programme : Diploma in Electrical and Electronic Engineering (DEEI)

Course : **MAT 1135: Engineering Mathematics 2**

Date of Examination : 6 December 2018 (Thursday)

Time : 5:00pm – 7:00pm 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) : Mr. 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 (DEEI)

## MAT1135 : ENGINEERING MATHEMATICS 2

## FINAL EXAMINATION: AUGUST 2018 SESSION

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

**Question 1**

- (a) Evaluate  $(1 + 2i)(3 + 4i)(1 - 2i)$ , giving your answer in rectangular form. (4 marks)
- (b) Given that  $z = -\sqrt{3} + i$ .
- Express  $z$  in polar form.
  - Use De Moivre's theorem to find  $z^4$  in rectangular form.
  - Find the square roots of  $z$ , leaving your answers in rectangular form correct to two decimal places. (13 marks)
- (c) Suppose  $z = \frac{x^2}{y}$ . If  $x$  increases at a rate of 2 cm/s at the instant when  $x = 3$  cm and  $y = 2$  cm, derive a suitable chain rule and use partial derivatives to find the rate at which  $y$  must change so that  $z$  will neither decrease nor increase. (8 marks)

**Question 2**

- (a) Find the following integrals.
- $\int \frac{x^2}{4x^3+5} dx$  (4 marks)
  - $\int x e^{2x} dx$  (3 marks)
  - $\int \frac{1}{4+9x^2} dx$  (5 marks)
  - $\int \frac{-x-5}{10x^2+x-3} dx$  (7 marks)
- (b) Derive Maclaurin series for  $f(x) = \cos 2x$  up to the third non-zero term. (6 marks)

**Question 3**

(a) Solve the following first order differential equations.

(i)  $\frac{dy}{dx} = \frac{x}{e^{2x} \cot y}$  (7 marks)

(ii)  $\frac{dy}{dx} - \frac{5y}{x} = x^2$  (8 marks)

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

(i)  $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} - 7y = 0$  (3 marks)

(ii)  $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 16y = 0$  (3 marks)

(iii)  $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 9y = 0$  (4 marks)

**Question 4**(a) Solve the second order differential equation  $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 5y = x^2$  using the method of undetermined coefficients.

(12 marks)

(b) Solve the following differential equation using Laplace transform:

$$\frac{d^2y}{dt^2} + y = 3e^{2t}$$

given that when  $t = 0$ ,  $y = 1$ ,  $\frac{dy}{dt} = 2$ .

(13 marks)

Laplace transforms of differential coefficients:

$$L\{y\} = \bar{y}$$

$$L\left\{\frac{dy}{dt}\right\} = s\bar{y} - y_0$$

$$L\left\{\frac{d^2y}{dt^2}\right\} = s^2\bar{y} - sy_0 - y_1$$

where  $y_0$  is the value of  $y$  when  $t = 0$ ;  $y_1$  is the value of  $\frac{dy}{dt}$  when  $t = 0$ .

**Question 5**

- (a) The output (in volts) from an electronic system is measured 40 times. The results are recorded as follows:

Voltage (V)	9.5	10.0	10.5	11.0	11.5
No. of measurements	6	14	8	7	5

Calculate the mean output voltage.

(3 marks)

- (b) The discrete random variable  $X$  has probability distribution as shown below.

$X$	1	2	3	4	5
$P(X = x)$	0.2	0.25	0.4	$d$	0.05

Find

- (i) the value of  $d$ ,
- (ii)  $P(1 \leq X \leq 3)$ ,
- (iii)  $P(X > 2)$ ,
- (iv)  $P(2 < X < 5)$ ,
- (v) the mode.

(5 marks)

- (c) The probability that an electronic component is acceptable is 0.93. Ten components are picked at random. What is the probability that

- (i) at least nine are acceptable,
- (ii) at most three are acceptable? Comment briefly on this result.

(10 marks)

- (d) The scores from IQ tests are normally distributed with a mean of 100 and a standard deviation of 15. What should a person score in order to be described as in the top 10% of the population?

(7 marks)