INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2018**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**MAT1122 : Engineering Mathematics 2**
Date of Examination	:	December 6, 2018 (Thursday)
Time	:	5:00 pm – 7:00 pm Reading Time: Nil
Duration	:	2 Hours
Special Instructions	:	

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

Materials permitted :
Non-Programmable Scientific Calculator

Materials provided :
Formula Booklet 1

Examiner (s)	:	**Chan Ah Wah** and Dr Chan Kah Yein
Moderator	:	Assoc Prof Chan Kait Loon

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

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
MAT1122 : 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 $z = -\sqrt{3} + i$.

(i) Express z in polar form.

(ii) Use De Moivre's theorem to find z^4 in rectangular form.

(iii) 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 inverse of matrix $\mathbf{A} = \begin{pmatrix} 1 & 4 & -2 \\ 2 & 1 & 0 \\ -1 & 3 & 1 \end{pmatrix}$ using adjoint method.

(15 marks)

(b) Solve the following system of linear equations using elementary row operations:

$$\begin{aligned} 2x - y + 3z &= 2 \\ x + 3y - z &= 11 \\ 2x - 2y + 5z &= 3 \end{aligned}$$

(10 marks)

Question 3

(a) Find the following integrals:

(i) $\int \frac{x^2}{4x^3+5}\, dx$ (4 marks)

(ii) $\int x e^{2x}\, dx$ (3 marks)

(iii) $\int \frac{1}{4+9x^2}\, dx$ (5 marks)

(iv) $\int \frac{-x-5}{10x^2+x-3}\, dx$ (7 marks)

(b) Derive Maclaurin series for $f(x) = \cos 2x$ up to the third non-zero term. (6 marks)

Question 4

(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 5

(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

$$L\{y\} = \bar{y}$$
$$L\{\frac{dy}{dt}\} = s\bar{y} - y_0$$
$$L\{\frac{d^2y}{dt^2}\} = s^2\bar{y} - sy_0 - y_1$$

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

-THE END -

MAT1122(F)/Aug2018/formatted