INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**January 2018**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**MAT1122 : Engineering Mathematics 2**
Date of Examination	:	March 9, 2018 (Friday)
Time	:	11:00 am – 1:00 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)	:	**Dr Ch'ng Pei Cheng** & Dr Chan Kah Yein
Moderator	:	Assoc Prof Chan Kait Loon

*This paper consists of **3** printed pages, including the cover page.*

DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)
MAT1122 : ENGINEERING MATHEMATICS 2
FINAL EXAMINATION : JANUARY 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. Working must be shown.

Question 1

(a) Evaluate $\frac{(2+5i)}{(1-3i)(2-i)}$, giving your answer in rectangular form. (5 marks)

(b) Express $z = -27$ in polar form. Use De Moivre's theorem to find the cube roots of z. Leave your answers in polar form. (10 marks)

(c) If $s = \frac{pq^4}{r^2}$, use differentials to find the percentage change in s when p decreases by 3%, q increases by 2% and r increases by 4%. (10 marks)

Question 2

(a) Find the inverse of matrix $\mathbf{A} = \begin{pmatrix} 2 & -3 & 4 \\ 1 & 0 & -5 \\ 6 & -2 & 1 \end{pmatrix}$. (15 marks)

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

$$\begin{aligned} 2x - 3y + 4z &= 5 \\ x + y - 3z &= 5 \\ 6x - 8y + 2z &= 8 \end{aligned}$$

(10 marks)

Question 3

(a) Find the following integrals.

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

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

(iii) $\int x^2 e^{2x}\,dx$ (5 marks)

(iv) $\int \frac{19x-11}{(10x^2-11x+3)}\,dx$ (7 marks)

(b) Derive Maclaurin series for $f(x) = \sin 3x$ up to the second non-zero term. (5 marks)

Question 4

(a) Solve the following first-order differential equations.

(i) $\frac{dy}{dx} = \frac{x \operatorname{cosec} y}{e^{2x}}$ (8 marks)

(ii) $\frac{dy}{dx} - y \tan x = \cos x$ (7 marks)

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

(i) $4\frac{d^2y}{dx^2} - 5\frac{dy}{dx} = 0$ (3 marks)

(ii) $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = 0$ (3 marks)

(iii) $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 5y = 0$ (4 marks)

Question 5

(a) Solve the second-order differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - 4y = 2 + x$ using the method of undetermined coefficients. (12 marks)

(b) Solve the following differential equation using Laplace transform: $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} - 10y = e^{2t}$, given that when $t = 0$, $y = 0$, $\frac{dy}{dt} = 1$. (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-