INTI International University & Colleges

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2017**
Programme	:	Diploma In Mechanical Engineering (DMEN)
Course	:	**MAT1122 : Engineering Mathematics 2**
Date of Examination	:	December 15, 2017 (Friday)
Time	:	8:00 am – 10:00 am 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 Chan Kah Yein,** Chan Ah Wah
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 2017 SESSION

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Question 1

(a) If $z_1 = -2 + 3i$ and $z_2 = 3 - 5i$, find $\frac{z_1}{z_1+z_2}$. Leave your answer in rectangular form. (5 marks)

(b) Express $z = -3 + 4i$ in polar form with the argument in degrees (to 1 decimal place). Use De Moivre's theorem to find the two square roots of z. Leave your answers in polar form with principal arguments. (10 marks)

(c) The centripetal acceleration of a particle moving in a circle is $a = \frac{v^2}{r}$, where v is the velocity and r is the radius of the circle. Use differentials to find the percentage change in the acceleration if v increases by 2% and r decreases by 3%. (10 marks)

Question 2

(a) Find the inverse of matrix $\mathbf{A} = \begin{pmatrix} 1 & 1 & 1 \\ 2 & 1 & -1 \\ 2 & -2 & 3 \end{pmatrix}$. (14 marks)

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

$$\begin{aligned} 4x + y + 4z &= 13 \\ 3x - y + 2z &= 2 \\ x + y + 4z &= 4 \end{aligned}$$

(11 marks)

Question 3

(a) Find the following integrals.

(i) $\int \frac{\ln x}{x}\, dx$ (3 marks)

(ii) $\int \frac{1}{\sqrt{4x^2+3}}\, dx$ (5 marks)

(iii) $\int x^2 \sin 3x\, dx$ (6 marks)

(iv) $\int \frac{x+7}{(6x^2+7x-3)}\, dx$ (5 marks)

(b) Derive Taylor's series for $f(x) = \tan x$ at $x = \frac{\pi}{6}$ up to the third non-zero term. (6 marks)

Question 4

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

(i) $(1+x^2)\frac{dy}{dx} = 5x - 2xy$ (8 marks)

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

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

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

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

(iii) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 7y = 0$ (4 marks)

Question 5

(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.

(12 marks)

(b) Solve the following differential equation using Laplace transform:
$\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + y = e^{2t}$, 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-

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