

 **INTI International  
University & Colleges**

**FINAL  
Examination Paper**

(COVER PAGE)

Session : April 2018

Programme : Diploma In Mechanical Engineering (DMEN)

Course : MAT1122 : Engineering Mathematics 2

Date of Examination : July 30, 2018 (Monday)

Time : 2:00 pm – 4:00 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 Chan Kah Yein and Dinesh A/L Kandasamy

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 : APRIL 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  $\frac{(1-3i)(2+3i)}{(4-i)}$ , giving your answer in rectangular form. (6 marks)
- (b) Express  $z = (1 - i)$  in polar form. Use De Moivre's Theorem to find  $z^8$  in polar and rectangular forms. (10 marks)
- (c) If  $I = \frac{V}{R}$ , where  $V = 200$  volts and  $R = 50 \Omega$ , use differentials to find the change in  $I$  resulting from a decrease of 4 Volts in  $V$  and an increase of  $0.6\Omega$  in  $R$ . (9 marks)

**Question 2**

- (a) Find the inverse of matrix  $A = \begin{pmatrix} 1 & -1 & 2 \\ 3 & -2 & 1 \\ 4 & 2 & 4 \end{pmatrix}$ . (15 marks)
- (b) Solve the following system of linear equations using elementary row operations:

$$\begin{aligned} 3x - 8y - 2z &= -19 \\ x - 3y + 4z &= 7 \\ 2x - 3y + 4z &= 8 \end{aligned} \quad (10 \text{ marks})$$

**Question 3**

- (a) Find the following integrals.
- (i)  $\int x^2 (x^3 + 2)^4 dx$  (4 marks)
- (ii)  $\int x \sin 3x dx$  (3 marks)
- (iii)  $\int \frac{1}{\sqrt{1-9x^2}} dx$  (5 marks)
- (iv)  $\int \frac{7x+1}{3x^2-7x+2} dx$  (7 marks)

- (b) Derive Taylor series for  $f(x) = \ln x$  at  $x = 3$  up to the third non-zero term. (6 marks)

#### Question 4

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

(i)  $\frac{dy}{dx} = \frac{(y^2+1) \tan^2 x}{y}$  (7 marks)

(ii)  $\frac{dy}{dx} + y \cot x = \cos x$  (8 marks)

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

(i)  $6 \frac{d^2y}{dx^2} + 5 \frac{dy}{dx} = 0$  (3 marks)

(ii)  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 12y = 0$  (3 marks)

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

#### Question 5

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

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

$\frac{d^2y}{dt^2} - 7 \frac{dy}{dt} + 12y = 2$ , given that when  $t = 0$ ,  $y = 1$ ,  $\frac{dy}{dt} = 5$ . (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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