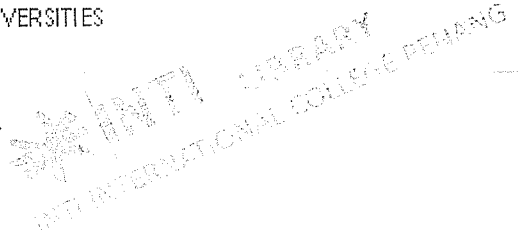


**INTI**

INTERNATIONAL COLLEGE PENANG (507232-U)  
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL  
Examination Paper  
(COVER PAGE)



Session : April 2012

Programme : Diploma in Electrical and Electronic Engineering Programme (DEE)

Course : MAT1122 : ENGINEERING MATHEMATICS 2

Date of Examination : 14 December 2012

Time : 11 a.m. – 1 p.m. 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 Scientific Calculator

Materials provided :  
Formula Booklet 1

Examiner(s) : Adele Kam

Moderator : Chan Ah Wah

*This paper consists of 5 printed pages, including the cover page.*

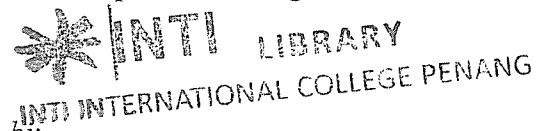
## INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRONIC AND ELECTRICAL ENGINEERING PROGRAMME (DEE/I)  
MAT 1122 : ENGINEERING MATHEMATICS 2

## FINAL EXAMINATION : AUGUST 2012 SESSION

Instructions: This paper consists of FIVE (5) questions. Answer any FOUR (4) questions in the answer booklet provided. All questions carry equal marks. Show complete working.

## Question 1



(a) Express each of the following answers in the form  $a + bi$ :

(i) Solve for  $z = \frac{3}{1+2i} - \frac{4}{1-2i}$  and graph  $z$  in an argand diagram. (4 marks)

(ii) Given  $z = \frac{1}{2} - \frac{1}{2}i$ , express  $z$  in exponential form. Also, use DeMoivre's theorem to find  $z^{10}$ . (5 marks)

(iii) Solve the equation  $2z^3 - \sqrt{3} - i = 0$  and find the roots of  $z$ . Let your answers be correct to 3 decimal places. (6 marks)

(b) (i) Given that  $A = \begin{bmatrix} 1 & 2 & 1 \\ 1 & 1 & 2 \\ 2 & 1 & 1 \end{bmatrix}$ , find  $A^{-1}$ . (7 marks)

(ii) Given that  $A = \begin{bmatrix} 3 & 1 & -1 \\ 2 & 0 & 3 \end{bmatrix}$ ,  $B = \begin{bmatrix} 1 & 4 \\ 2 & -3 \\ -1 & 3 \end{bmatrix}$  and  $C = \begin{bmatrix} 5 & 1 \\ -1 & 2 \end{bmatrix}$ , compute  $AB - 2C$ . (3 marks)

## Question 2

(a) Evaluate the following integrals:

(i)  $\int \frac{x-1}{(2x+1)^2(x-2)} dx$  (8 marks)

(ii)  $\int \frac{2x-1}{x^2+6x+16} dx$

(6 marks)

(iii)  $\int \sec^2 \frac{x}{a} \tan \frac{x}{a} dx$

(3 marks)

(b) Find  $\frac{\partial w}{\partial r}$  and  $\frac{\partial w}{\partial t}$ , where  $w = \frac{xy}{x+y}$  and  $x = \sin(r^2t)$  and  $y = e^{3r+2t}$ .

(8 marks)

### Question 3

- (a) Given a right cylinder with height  $h = 75$  cm, and radius  $r = 65$  cm, approximate the percentage change in surface area if the height is decreased 1% and the radius is increased 3%.

(5 marks)

- (b) (i) Derive  $f(x) = e^{2x} \ln(x+1)$  using Maclaurin series up to and including the term in  $x^4$ . Hence approximate  $\int_0^{0.5} e^{2x} \ln(x+1) dx$  correct to four (4) decimal places.

(7 marks)

- (ii) Use the binomial series to find  $\frac{1}{\sqrt{1-x^2}}$  in ascending powers of  $x$  up to and including the term in  $x^8$ .

(4 marks)

- (c) Solve the following differential operations:

(i)  $\frac{dy}{dx} + x + xy^2 = 0$ , given  $y = 0$  when  $x = 1$ .

(3 marks)

(ii)  $x^2 \frac{dy}{dx} = y^2 - xy \frac{dy}{dx}$ , given that  $y = 1$  when  $x = 1$ .

(6 marks)

### Question 4

- (a) The amount of a certain bacteria culture increases proportionally to the amount present at any time. It was found that the culture grew from 200 g to 500 g in the period from 6 am to 9 am. How many grams will be present at noon?

(6 marks)

(b) Solve  $\frac{d^2x}{dt^2} - 6\frac{dx}{dt} + 8x = e^{3t}$ , given that at  $t = 0$ ,  $x = 0$ ,  $\frac{dx}{dt} = 2$ .

INTI LIBRARY  
INTERNATIONAL COLLEGE PENANG

(6 marks)

(c) Use Euler Method to solve the values of  $y$  for  $x = 1.0$  (0.1) 1.4 if

$$(x^2 + y^2)\frac{dy}{dx} = xy, y(1) = 1.$$

Give your answers correct to four (4) decimal places.

The formula of Euler's method is given below.

$$\frac{dy}{dx} = f(x, y)$$

$$x_1 = x_0 + h$$

$$y_{n+1} = y_n + hf(x_n, y_n)$$

(5 marks)

(d) Find the following Laplace transforms:

(i)  $L\{e^{3t}(t^2 + 4)\}$

(3 marks)

(ii)  $L^{-1}\left\{\frac{s^2 + 3s - 7}{(s-1)(s^2 + 2)}\right\}$

(5 marks)

### Question 5

(a) Solve using Laplace transform the differential equation  $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 8y = 6e^{4x}$ , given that

when  $x = 0$ ,  $y = 2$  and  $\frac{dy}{dx} = 11$ .

(7 marks)

(b) A firm has two photocopying machines. The old one is available for use 80% of the time and new one is available for use 95% of the time. The machine availabilities are independent of each other.

Find the probability that, at a random time,

(i) both machines are available

(2 marks)

(ii) only one machine is available

(2 marks)

- (iii) at least one machine is available (2 marks)
- (iv) neither machine is available (2 marks)
- (c) The monthly demand for a product is normally distributed with a mean of 2,000 and a standard deviation of 200. Find the probability that the demand in a given month will be
- (i) more than 2,350 (2 marks)
- (ii) less than 1,600 (2 marks)
- (iii) between 1,500 and 2,500 (2 marks)
- (d) An automatic machine produces, on average, 10% of its components outside of a tolerance required. In a random sample of 10 components produced by this machine, determine the probabilities of having exactly three components outside of the tolerance required by assuming a binomial distribution. (4 marks)

--THE END--

<MAT1122(F)/Aug12/Adele Kam 19/10/12>