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 $z = \dfrac{3}{1+2i} - \dfrac{4}{1-2i}$ and graph $z$ in an argand diagram.

(4 marks)

(ii) Given $z = \dfrac{1}{2} - \dfrac{1}{2}i$, 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) $\displaystyle\int \frac{x-1}{(2x+1)^2(x-2)}\,dx$

(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 $x = \sin(r^2 t)$ 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 $t = 0$, $x = 0$, $\frac{dx}{dt} = 2$.



(6 marks)

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

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

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

(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)*