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FINAL
Examination Paper

(COVER PAGE)

Session	:	**AUGUST 2014**
Programme	:	Diploma in Electrical and Electronic Engineering (DEEI)
Course	:	**MAT 1122: Engineering Mathematics 2**
Date of Examination	:	December 11, 2014 (Thursday)
Time	:	3.00pm – 5.00pm 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 calculator

Materials provided :

Formula Booklet 1

Examiner(s)	:	**Chan Ah Wah**
Moderator	:	**Dr. Ch'ng Pei Eng**

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

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (DEEI)

MAT1122 ENGINEERING MATHEMATICS 2

FINAL EXAMINATION : AUGUST 2014 SESSION

Instructions

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a) Find the values of p and q from the following equations :

(i) $i(p+qi) = (1-2i)(3+i)$

[3 marks]

(ii) $\dfrac{i}{p+qi} = \dfrac{2}{3+4i}$

[3 marks]

(b) Solve the equation $z^3 + 1 + i = 0$, giving your answer in trigonometric form .

[6 marks]

(c) Use De Moivre's Theorem to express $\left(\frac{1}{2} + \frac{1}{2}i\right)^{10}$ in the form of $a + ib$.

[5 marks]

(d) Use Euler's method to find the values of y for $x = 0.0(0.1)0.4$ if

$$\frac{dy}{dx} = y^2(1+2x), \quad y(0) = 1.$$

Let all workings be correct to **four (4)** decimal places . The formula for Euler's method is given by :

$$\frac{dy}{dx} = f(x,y)$$
$$x_{n+1} = x_n + h$$
$$y_{n+1} = y_n + hf(x_n, y_n)$$

[8 marks]

Question 2

Evaluate the following integrals :

(a) $\int \frac{1}{8+2x^2}\,dx$

[5 marks]

(b) $\int x^2 \sin x\,dx$

[5 marks]

(c) $\int \frac{x^3+x+1}{x^4+x^2}\,dx$

[6 marks]

(d) $\int \sin^3 x\,dx$

[5 marks]

(e) $\int \frac{\ln x}{x}\,dx$

[4 marks]

Question 3

(a) Given that $z = e^{x+y}\sin\left(x^2y^3\right)$, find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$.

[6 marks]

(b) The coefficient of rigidity (G) of a wire of length L and uniform diameter M is given by

$$G = \frac{AL}{M^4}$$

where A is a constant. If errors of $\pm 0.25\%$ and $\pm 1\%$ are possible in measuring L and M respectively, determine the maximum percentage error in the calculated value of G.

[3 marks]

(c) If $z = 2xy - 3x^y$ and x is increasing at the rate of $2\,\text{cm/s}$, determine at what rate y must be changing in order that z shall be neither increasing nor decreasing at the instant when $x = 3\,\text{cm}$ and $y = 1\,\text{cm}$. Give your answer correct to four decimal places.

Hint: $x^y = e^{y\ln(x)}$. [4 marks]

(d) Use the series

$$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$$

to expand $\ln\left(\frac{1-2x}{1+2x}\right)$ as a series of ascending powers of x up to and including the term in x^5.

[6 marks]

(e) (i) Derive the binomial series for $(1+x^2)^{-1}$ up to the first four non-zero terms .

[2 marks]

(ii) Hence, use the result in (i) to evaluate the integral

$$\int_0^{0.4} \frac{x}{1+x^2}\,dx$$

Let your answer be correct to **four (4)** decimal places .

[4 marks]

Question 4

(a) The rate of change of temperature of a motor is given by

$$\frac{d\theta}{dt} = 10 - k\theta$$

where θ is the temperature of the motor at time t and k is a non-zero constant. Given that $\theta = 0$ when $t = 0$, and $\theta = 60$ when $t = 10$. Show that $e^{-10k} = 1 - 6k$.

[5 marks]

(b) Solve the following differential equations :

(i) $(1+x^2)\frac{dy}{dx} + 3xy = 5x$

[6 marks]

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

[5 marks]

(iii) $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 2x^2$

[9 marks]

Question 5

(a) Use Laplace transform to solve the following differential equation :

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = \sin 2t$$

given that $y(0) = 0$ and $y'(0) = 0$.

[10 marks]

(b) Batteries from a particular manufacturer have a mean lifespan of 160 hours, with standard deviation of 30 hours. Assuming that lifespan of batteries follows a normal distribution, find the probability of selecting a battery with a lifespan between 150 hours and 180 hours .

[6 marks]

(c) The table below shows the daily wages earned by 80 students who worked part time during their semester break :

Weekly wage (RM)	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44
Frequency	4	8	14	22	19	10	3

Estimate, for the above distribution,

(i) the mean, [4 marks]

(ii) the standard deviation . [5 marks]

End of Paper

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