INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES*

FINAL
Examination Paper

(COVER PAGE)

Session	:	JANUARY 2013
Programme	:	DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING
Course	:	**MAT1121: Engineering Mathematics 1**
Date of Examination	:	6 March 2013
Time	:	11a.m. – 1p.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 Calculator

Materials provided :

Formula Booklet 1

Examiner(s) : **Chan Ah Wah**

Moderator : **Teng Mei Tuan**

This paper consists of 4 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (DEEI)

MAT1121 ENGINEERING MATHEMATICS 1

FINAL EXAMINATION : JANUARY 2013 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) (i) Find the values of k for which $(2x-1)$ is a factor of $f(x) = 2x^3 + x^2 - kx + 30$. [3 marks]

(ii) Solve $\sqrt{x+19} = \sqrt{x-20} + 3$. [4 marks]

(iii) Sketch the graph of $y = 4x^2 - 3x + 1$. [3 marks]

(b) Solve the following equations :

(i) $\log_4(3 - x^2) = -6.2$ [3 marks]

(ii) $2^{2x} - 2^{x+3} - 2^{x+1} + 2^4 = 0$ [4 marks]

(iii) $2^{x-5}\,5^{x+1} = 62.5$ [3 marks]

Let your answer be correct to two (2) decimal places wherever applicable .

(c) Solve the cubic equation $f(x) = 4x^3 + 7x^2 - 6x - 5 = 0$. [5 marks]

Question 2

(a) Solve the following equations for $0° \leq x \leq 360°$:

(i) $2\cos 2x = -1$ [5 marks]

(ii) $5\tan x + 6 = 2\sec^2 x$ [5 marks]

(iii) $3\sin^2 x - \cos^2 x = \sin 2x$ [5 marks]

(b) Prove the identity $(\sin\theta - \cos\theta)^2 + (\sin\theta + \cos\theta)^2 = 2$. [5 marks]

(c) State the amplitude, period, and phase shift of $y = 2\sin\left(\frac{1}{4}x + \frac{\pi}{2}\right)$. Hence, sketch the curve and that of $y = 2\sin\left(\frac{1}{4}x\right)$ for one cycle (in the same diagram) . [5 marks]

Question 3

(a) The sum of 6 terms of an arithmetic series is 45, the sum of 12 terms is -18. Find the first term and the common difference .

[4 marks]

(b) A geometric series has $a = 6$ and $r = \frac{1}{2}$. Find the difference between its liminting sum and the sum of the first five (5) terms .

[4 marks]

(c) Find, in ascending powers of x, the first 4 terms in the expansion of $\left[1 - \frac{x}{4}\right]^{10}$. Hence, find the coefficient of x^3 in the expansion of

$$2\left[1 - \frac{x}{4}\right]^{10} + 3\left[1 - \frac{x}{4}\right]^{11} + 4\left[1 - \frac{x}{4}\right]^{12}.$$

Leave your answer in the form $\frac{p}{q}$, where p and q are whole numbers .

[8 marks]

(d) In Figure Q3(d), ABC is an equilateral triangle of side 2 cm. The mid-point of BC is Q. An arc of a circle with centre A touches BC at Q, and meets AB at P and AC at R. Find the total area of the shaded regions, giving your answer in terms of π and $\sqrt{3}$.

[9 marks]

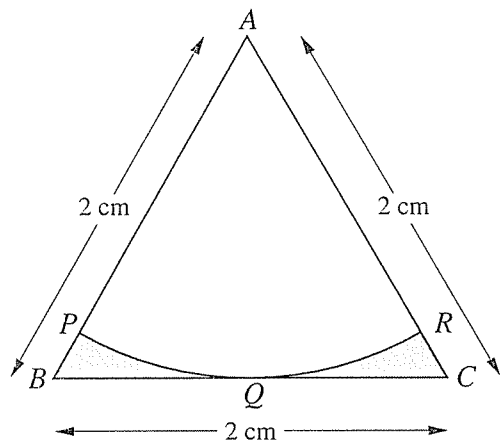

Figure Q3(d)

Question 4

(a) Differentiate the following functions with respect to x :

(i) $y = \ln 2x + \sqrt{5x-2}$

[3 marks]

(ii) $y = \sin^4 x \cos^3 x$

[3 marks]

(iii) $y = \dfrac{e^x}{e^x + 1}$

[4 marks]

(b) Find the equations of the tangent and normal of the curve $y = 11 - \dfrac{10}{4-x}$ at the point $(6,\ 16)$.

[5 marks]

(c) If $y = e^x \cos 2x$, prove that $3y' - 2y'' - 9y = 2e^x \sin 2x$.

[5 marks]

(d) For the curve $xy(x+y) = 84$, find $\dfrac{dy}{dx}$ at $(3,\ 4)$.

[5 marks]

Question 5

(a) Evaluate the following integrals :

(i) $\displaystyle\int \sqrt{4-2x}\,dx$

[3 marks]

(ii) $\displaystyle\int 3\sin(6x-1)\,dx$

[3 marks]

(iii) $\displaystyle\int \frac{1-6x}{3+2x-6x^2}\,dx$

[3 marks]

(b) Use Simpson's rule to evaluate $\displaystyle\int_{0.2}^{1} \sqrt{1+x^3}\,dx$ using 8 equal intervals. Show your workings in the form of a table with answers correct to 4 significant figures .

[6 marks]

(c) Find the area enclosed by the functions $y = 5e^x$, $y = x^3$, $x = 1$ and $x = 4$. Let your answer be correct to two (2) decimal places .

[5 marks]

(d) Use Newton's method to obtain a root of the equation $x^5 - 5x^3 - 2 = 0$ with the initial value $x_o = 2$. Let all workings be correct to eight (8) decimal places .

[5 marks]

—— End of Paper ——