INTI
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FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2015**
Programme	:	Diploma in Electrical and Electronic Engineering (DEEI)
Course	:	**MAT1121: Engineering Mathematics 1**
Date of Examination	:	10th December 2015 (Thursday)
Time	:	8:00am – 10:00am 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)	:	**Ms. Chong Mee Teng**
Moderator	:	**Dr. Ch'ng Pei Eng**

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

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)
MAT 1121: ENGINEERING MATHEMATICS 1
FINAL EXAMINATION: AUGUST 2015 SESSION

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) Solve the following equations:

(i) $2^{2x} - 2^{x+3} + 7 = 0$. (5 marks)

(ii) $1 - x = \sqrt{-5x+1}$. (4 marks)

(b) Express $\dfrac{\sqrt{3}-3}{\sqrt{3}-1}$ as a single fraction with rational denominator. (3 marks)

(c) Given that $(x-1)$ and $(x+2)$ are both factors of the expressions $f(x)$ where $f(x) = 2x^4 + px^3 + qx^2 - x + 6$, find the value of p and of q. Hence, factorize $f(x)$ completely. (6 marks)

(d) Find the range of values of q for which the equation $x^2 + 6x + q^2 - 7 = 0$ has real roots. (3 marks)

(e) Express $y = x^2 - 5x + 13$ in the form $y = (x-p)^2 + q$ where p and q are constants. Hence, sketch the graph of $y = x^2 - 5x + 13$. (4 marks)

Question 2

(a) Find x for each of the following cases for $0^o \leq x \leq 360^o$.

(i) $3\sin^2 x - \cos^2 x = \sin 2x$. (6 marks)

(ii) $\dfrac{7\sin x + 6}{1 - \sin x} = 3$. (6 marks)

(b) Prove the identity: $2\tan x = \dfrac{\cos x}{\operatorname{cosec} x - 1} + \dfrac{\cos x}{\operatorname{cosec} x + 1}$. (5 marks)

(c) State the amplitude, period and phase shift of $y = \sin(2x + 15^\circ)$. Hence, sketch the curve for one oscillation. (5 marks)

(d) Covert $(-5, -12)$ from rectangular to polar coordinates. (3 marks)

Question 3

(a) The sum of the 13 terms of an arithmetic progression is 286 and the common difference is 3. Determine the first term of the series. (3 marks)

(b) The sum of the 2nd and 4th term in a geometric progression is 90 and the sum of the 4th and the 6th is 10. Given that r is positive, find:

(i) the common ratio, (3 marks)

(ii) the first term, (2 marks)

(iii) the least numbers of terms required to make the sum exceed 364.42. (3 marks)

(c) Expand and simplify the first five terms of $(x^2 - 2)^9$ by using the binomial theorem. (3 marks)

(d) In the expansion of $(4 + \frac{1}{2x})^{12}$, the coefficient of $\frac{1}{x^3}$ is k times the coefficient of $\frac{1}{x^4}$. Calculate the value of k. (3 marks)

(e) Given that AB = 4 cm, BC = 4 cm, CD = 6 cm and ∠ADC = 70° in **Figure (1)**. Find:

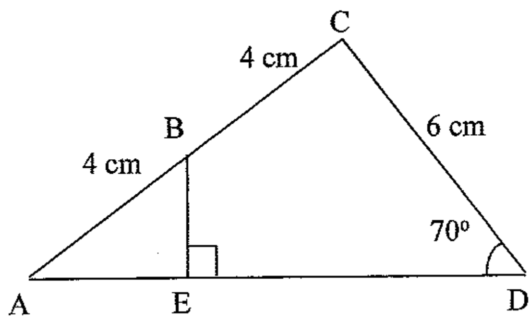

Figure (1)

(i) the angle ∠CAD, (3 marks)

(ii) the area of BCDE. (5 marks)

Question 4

(a) Find $\frac{dy}{dx}$ for each of the following:

(i) $y = \dfrac{1}{(2x^4 - x^2 + 1)^3}$. (3 marks)

(ii) $y = x^2 \sin 3x$. (3 marks)

(iii) $y = \dfrac{e^{4x} + 1}{e^{4x} - 1}$. (3 marks)

(b) Find the tangent equation of the curve $x^2 y - 3xy^3 + y^2 = -1$ at the point (2, 1). (5 marks)

(c) Find the stationary points of the function $y = x^3 - 6x^2 + 12$ and determine the nature of the stationary points. Hence sketch the graph of the function. (6 marks)

(d) The radius of a circle increases at the rate of 0.6 cms^{-1}. Calculate the rate of increase of the area when the radius is 10.0 cm and 15.0 cm respectively. (5 marks)

Question 5

(a) Find the following integrals:

(i) $\int 4\sin 2x + 3\cos 2x \; dx$. (3 marks)

(ii) $\int \dfrac{x}{1 - 4x^2} \; dx$. (3 marks)

(iii) $\int_1^2 3e^{2x} + 3 \; dx$. (3 marks)

(b) Use the trapezoidal rule to evaluate $\int_0^{\frac{\pi}{2}} \dfrac{1}{1 + \sin x} \, dx$ using 5 equal intervals. Show your working in the form of a table and give your final answer to 4 significant figures. (5 marks)

(c) Use the Newton's Method to obtain a root of the equation $3x^3 - 10x = 14$ with the initial value, $x_o = 2$. Give your answer correct to three decimal places. (5 marks)

(d) Find the area enclosed by the curve $y = 4x^2$ and $y^2 = 2x$. (6 marks)

–THE END–