INTI
International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2019**
Programme	:	Diploma in Electrical and Electronic Engineering (DEEI)
Course	:	**MAT 1136: Engineering Mathematics 3**
Date of Examination	:	12 December 2019 (Thursday)
Time	:	5:00pm – 7:00pm 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)	:	**Mr. Dinash A/L Kandasamy**
Moderator	:	Dr. Ch'ng Pei Eng

This paper consists of 3 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)
MAT1136: ENGINEERING MATHEMATICS 3
FINAL EXAMINATION: AUGUST 2019 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) Solve the following system of linear equations using elementary row operation

$$4x - 3y - z = -11$$
$$2x - y + z = -3$$
$$x + y - z = 0$$

(8 marks)

(b) Use Cramer's rule to solve for z in the following system

$$2x - 4y + z = 12$$
$$x + 3y - 2z = 1$$
$$3x + y - 4z = 19$$

(6 marks)

(c) Let matrix $A = \begin{bmatrix} 2 & -4 \\ -3 & 1 \end{bmatrix}$

i. Find eigenvalues of matrix A,

(4 marks)

ii. Find the eigenvectors for matrix A.

(7 marks)

Question 2

(a) Let the points $A(1,-2,3)$, $B(3,-2,1)$ and $C(-3,-2,1)$. Find the following

i. vectors $\overrightarrow{\boldsymbol{AB}}$ and $\overrightarrow{\boldsymbol{BC}}$

(4 marks)

ii. vector orthogonal to $\overrightarrow{\boldsymbol{AB}}$ and $\overrightarrow{\boldsymbol{BC}}$

(4 marks)

iii. equation of plane containing points A, B and C.

(6 marks)

(b) The position vector of a particle is $\vec{r}(t) = 2t^2\hat{\imath} + \sin 2t\ \hat{\jmath} + \cos 3t\ \hat{\boldsymbol{k}}$ where t is time and $t \geq 0$. Let P be point $P(2\pi^2, 0,1)$. Find the

i. value of t at point P,

(3 marks)

ii. velocity vector, $\vec{v}$ and acceleration vector, $\vec{a}$ at point P.

(8 marks)

Question 3

(a) Evaluate the line integral $\oint_C \; xy\,\mathrm{d}x + x^2y^3\mathrm{d}y$ where C is the triangular path with vertices (0,0), (1,0) and (1,2), in the counter clockwise direction using

i. Green's theorem

(8 marks)

ii. Line integration

(11 marks)

(b) Given that $f = x^2y^2 + 3y^2z - 4xyz^2$ and $\vec{\boldsymbol{v}} = 4\hat{\imath} - 3\hat{\jmath} + 4\hat{\boldsymbol{k}}$, find the directional derivative of f in the direction $\vec{\boldsymbol{v}}$ at the point $(3,2,-1)$.

(6 marks)

Question 4

(a) Use Stokes' theorem to evaluate $\oint_S \; \mathrm{curl}(\overrightarrow{\boldsymbol{F}}) \cdot \mathrm{d}\boldsymbol{S}$ where $\vec{\boldsymbol{F}} = 3z^2\hat{\imath} - y^2\hat{\imath} + 2x\hat{\boldsymbol{k}}$ and S is the part of $z = 6 - x^2 - y^2$ and above the plane $z = 2$.

(10 marks)

(b) Show that the line integral is path independent in a conservative field

(10 marks)

(c) Let the vectors $\vec{\boldsymbol{u}} = 4\hat{\imath} - 2\hat{\jmath} - 3\hat{\boldsymbol{k}}$ and $\vec{\boldsymbol{v}} = -\hat{\imath} + 2\hat{\jmath} + 3\hat{\boldsymbol{k}}$ **.** Find the angle between the two vectors. Leave your answer in 2 decimal places.

(5 marks)

Question 5

(a) Use Gauss' Divergence Theorem to evaluate $\oiint_S \; \vec{\boldsymbol{F}} \cdot \mathrm{d}\vec{\boldsymbol{S}}$ where, $\vec{\boldsymbol{F}} = xy\hat{\imath} - \frac{1}{2}y^2\hat{\boldsymbol{\jmath}} + z\hat{\boldsymbol{k}}$ and $\boldsymbol{S}$ is a surface of solid completely enclosed by the cylinder $x^2 + y^2 = 9$ and the planes $z = 0$ and $z = 5$

(16 marks)

(b) Set up double integral with the correct limits to evaluate the area of following regions. Do not integrate.

i. The region bounded by the circle $x^2 + y^2 = 9$ and the lines $y = x$ and $x - axis$ in the first quadrant

(4 marks)

ii. The region bounded by the curve $y = x^2$ and the lines $y = 8 + 2x$ and $y = 0$ in the first quadrant.

(5 marks)

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