INTI INTERNATIONAL UNIVERSITY

FOUNDATION IN SCIENCE (CFSI)
MAT1211: MATHEMATICS 2
FINAL EXAMINATION: MAY 2016 SESSION

Instruction: 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 by using Cramer's rule:

$$x + 2y + 2z = 4$$
$$3x - y + 4z = 25.$$
$$3x + 2y - z = -4$$

(7 marks)

(b) Determine the inverse of $\begin{bmatrix} -1.3 & 7.4 \\ 2.5 & -3.9 \end{bmatrix}$.

(3 marks)

(c) If $Z_1 = 1 + 2j, Z_2 = 4 - 3j, Z_3 = -2 + 3j,$ and $Z_4 = -5 - j.$ Evaluate in $a + bj$ form:

(i) $\dfrac{Z_1}{Z_2}$,

(3 marks)

(ii) $\dfrac{Z_1 + Z_3}{Z_2 - Z_4}$.

(4 marks)

(d) Give $Z_5 = -2 + 7j.$

(i) Express Z_5 in polar form.

(4 marks)

(ii) Apply DeMoivre's theorem to evaluate ${Z_5}^4$, giving your answer in rectangular form.

(4 marks)

Question 2

(a) The data below shows the weights of 105 students in 5T1 class.

Class Interval	Frequency
29.5 – 39.5	1
39.5 – 49.5	4
49.5 – 59.5	6
59.5 – 69.5	13
69.5 – 79.5	20
79.5 – 89.5	39
89.5 – 99.5	22

(i) Find the mean of the data.

(1 mark)

(ii) Find the mode of the data using formula.

(2 marks)

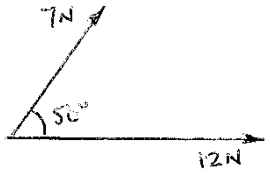
(iii) Find the median of the data using formula.

(3 marks)

(iv) Find the standard deviation of the data using formula.

(3 marks)

(b) A force of 7 N is inclined at an angle of 50° to a second force of 12 N, both forces acting at a point. Calculate magnitude of the resultant of the two forces, and the direction of the resultant with respect to the 12 N force. The two forces are shown in the diagram.



(8 marks)

(c) (i) A Christmas gully bag contains 3 white balls and 8 red balls. If three balls are picked at random one after another without replacement from the gully bag, what is the probability of picking three white balls?

(2 marks)

(ii) There are 100 families in a village, 57 of them have star fruit trees, 30 have guava trees and 20 have both. A family is selected at random from the village. Find the probability that the family selected has star fruit trees or guava trees.

(2 marks)

(iii) Two six-sided dice, C and D, are used in a game. Dice C has 3 yellow sides and 3 white sides. Dice D has 4 yellow sides and 2 white sides. Both of the dice are thrown together. Find the probability that both dice have a yellow side facing upwards.

(2 marks)

(iv) 50 students were surveyed on their leisure activities. 37 said they surfed the Internet and 40 liked to dance. Find the probability that a student chosen at random surfed the Internet and dance.

(2 marks)

Question 3

(a) Evaluate $\int_2^5 \frac{1}{\sqrt{(2x-1)}} dx$ using trapezoidal rule. Use 6 intervals and gives answer correct to 4 decimal places.

(6 marks)

(b) Find the first four non-zero terms of the Maclaurin's series for $f(x) = (1+x)^{\frac{3}{4}}$.

(6 marks)

(c) Find the first four non-zero terms of the Taylor's series for $f(x) = \tan x$ at the point $x = \frac{\pi}{4}$.

(6 marks)

(d) Solve the equation $\frac{dy}{dx} = 2x - y$ by using the Euler Method, given the initial condition $x = 0, y = 1,$ and $h = 0.2.$ Find an approximate value of y at $x = 0.2$.

(2 marks)

(e) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using Simpson's rule with four subdivisions.

(5 marks)

Question 4

(a) Find the $f_x, f_y, f_{xx}, f_{xy}, f_{yy}, f_{yx}$ for the functions given below:

(i) $f(x, y) = 3e^{xy^3}$,

(6 marks)

(ii) $f(x, y) = \sin(x + y^2)$.

(6 marks)

(b) (i) If $z = f(x, y)$ and $z = 3x^2y^5$, find the rate of change of z when x is 3 units and y is 2 units and when x is decreasing at the rate of 5 units per second and y is increasing at 2.5 units per second.

(5 marks)

(ii) Given $P = w^2hd$. If errors of 3% are possible in the measured values of *w*, *h* and *d*, find the maximum possible percentage error in the calculated value of *P*.

(5 marks)

(c) Solve the first order ordinary differential equation $\frac{dy}{dx} + y = 2$ using the method of integrating factor.

(3 marks)

Question 5

(a) Find the general solution of the differential equation: $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 0.$

(4 marks)

(b) Find the particular solution of the differential equation $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = 0$ when $\frac{dy}{dx} = 4, x = 0$ and $y = -4.$

(10 marks)

(c) Find the general solution of the differential equation: $\frac{d^2y}{dx^2} - 9y = 3\cos x.$

(11 marks)

--THE END--