ELIZADE UNIVERSITY, ILARA-MOKIN
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
FIRST SEMESTER 2020/2021 SESSION

Course Title: Engineering Mathematics. **Course Code:** GNE211 **UNITS:** 3
INSTRUCTION: **Attempt any Four (4) Questions** Time allowed: 3hrs

HOD'S SIGNATURE

QUESTION ONE (15 Marks)

1a. If a and b are real, express the following in terms of $(a + Jb)$:
$x^2 + 2x + 5 = 0$ b. $j(\frac{(1+j3)}{(1-j2)})^2$ C. $(2 + J3) + (3 - J4)$

(6 Marks)

1b. Find the derivative with respect to x of $y = 4sin^2 4x$ and $((x)^5 + 1)(5 - \frac{1}{x^3})$ **(4 Marks)**

1c. Evaluate $\int \left(\frac{4w+3}{4w^2+6-1}\right) dw$ **(2 Marks)**

1d. Determine the inverse matrix of $\begin{pmatrix} 7 & 3 \\ -1 & 4 \end{pmatrix}$ **(3 Marks)**

QUESTION TWO (15 Marks)

2a. Convert (i) $4 < 30^0$ (ii) $47 < 30 - 145^0$ into $(a + Jb)$ form, correct to significant figures **(4 Marks)**

2b. Solve Cos 5x **(7 Marks)**

2c. The luminous intensity I candelas of a lamp at varying voltage V is given by $I = 5\,x10^{-4}V^2$. Determine the voltage at which the light is increasing at a rate of 0.4 candelas per volt.

(4 Marks)

QUESTION THREE (15 Marks)

3a. Solve the following using first principle:

i. Sin x ii. Cos x iii. $5(x)^2$ **(9 Marks)**

3b. Given a 2 by 2 matric A as follow:

$A = \begin{pmatrix} \frac{1}{2} & \frac{2}{3} \\ \frac{-1}{3} & \frac{-3}{5} \end{pmatrix}$ prove that $AxA^{-1} = I$ **(4 Marks)**

3c. Express the complex number in polar form: $(3 + J4)$ **(2 Marks)**

QUESTION FOUR (15 Marks)

4a. Newton's law of cooling is given by $\theta = \theta_0 e^{-kt}$ where the excess of temperature at 0 zero time is θ_0 ∘C and at time t seconds is θ ∘C. Determine the rate of change of temperature after 50s, given that θ_0 = 18∘C and k =−0.06 **(6 Marks)**

4b. Simplify $\begin{pmatrix} 1 & 0 & 2 \\ 8 & 0 & 1 \\ 2 & 0 & 1 \end{pmatrix} \text{x} \begin{pmatrix} 1 \\ 3 \\ 1 \end{pmatrix}$ **(2 Marks)**

4c. Solve Sin 5x **(7 Marks)**

QUESTION FIVE (15 Marks)

5a. Determine $\begin{pmatrix} 1 & 0 & 3 \\ 2 & 1 & 2 \\ 1 & 4 & 1 \end{pmatrix} x \begin{pmatrix} 1 & 2 & 0 \\ 1 & 10 & 2 \\ 3 & 2 & 0 \end{pmatrix}$ **(3 Marks)**

5b. Determine the inverse matric of $A = \begin{pmatrix} 1 & 4 & 3 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$ **(9 Marks)**

5c. Find the sum of the series 1 + 3·5 + 6 + 8·5 + . . . + 101 . **(3 Marks)**

QUESTION SIX (15 Marks)

6a. Evaluate $\int (8x - 12)\,(4x^2 - 12x)^4$ **(4 Marks)**

6b. Determine the two square roots of the complex number $(5 + J12)$ in polar form and cartesian forms and show the roots on an argand diagram **(4 Marks)**

6c. Find the sum of the first 50 terms of the sequence 1, 3, 5, 7, 9, ... **(4 Marks)**

6d. Using the first Principle approach. Simplify $y = (4(x)^3 + 3x^2)$ **(3 Marks)**