CATHOLIC UNIVERSITY INSTITUTE OF BUEA
2020/2021 ACADEMIC YEAR
First Semester Examinations – February 2021

School			ENGINEERING		
Course Code	EMA 201	Course Title	Engineering Mathematics II		
Status	C	Credit Value	6	Department	MEE
Date	26/02/2021	Venue	Ngongi Hall, LH 11	Time	10:30 – 12:30
Course Master(s)		Yagaka Fokoua Gabriel			

Instructions :

- Answer **ALL** questions
- Penalty will be given for poor presentation of answers
- Electronic Calculators are allowed.

Question 1 (5 marks)

What do you understand by the following terms as used in numerical analysis

a) Relative error

b) Approximation error

Question 2 (16 marks)

a) Consider the function $f(x) = x^2 - 3$ defined on the interval [1,2] and let $\epsilon = 0.001$ be the tolerance. Using the Bisection method, approximate the root of the function $f(x)$ in the interval [1,2]. **(6 marks)**

b) Let $g(x) = x - \frac{1}{2}(x^2 - 3)$

    (i) Find the fixed points of g. **(2marks)**

    (ii) To which of the fixed points of g does the algorithm $x_{n+1} = x_n - \frac{1}{2}((x_n)^2 - 3)$ converge? **(3 marks)**

    (iii) Find the approximate value of the fixed point of g to which the algorithm converges using the starting point $x_0 = 1$. **(5 marks)**

Question 3 (15 marks)

Given the four data points (−1, 1), (0, 1), (1, 2), (2, 0), determine.

a) The Vandermonde interpolating polynomial. **(7 marks)**

b) The Lagrange interpolating polynomial. **(8 marks)**
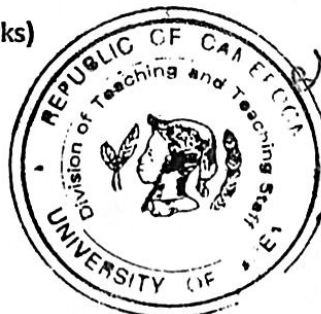
Question 4 (14 marks)

Let f be an arbitrary continuous function and a and b with a < b be two real numbers.

a) For the numerical integration of f from a to b, what is the formula for the :
    - The composite Trapezoidal rule; **(2 marks)**
    - The composite Simpson's rule. **(2 marks)**

b) For $f(x) = xe^x$, a = 0, and b = 1, and taking $n=5$ find the approximate values of $\int_0^1 xe^x dx$ for each

   of the rules above. **(4+4 marks)**

c) Which of the rules gives the best approximation? **(2 mark)**

Good Luck