Kasarani Campus
Off Thika Road
P. O. Box 49274, 00101
NAIROBI
Westlands Campus
Pamstech House
Woodvale Grove
Tel. 4442212
Fax: 4444175

KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS, 2023/2024 ACADEMIC YEAR
SECOND YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS)

KMA 107 - INTRODUCTION TO NUMERICAL ANALYSIS

Date: 20th April 2023
Time: 4.00 – 6.00pm

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) i) Convert the hexadecimal number $(2B7.3D2)_{16}$ to Denary number system. (3Marks)

ii) Convert $(11101111010000100100001)_2$ to hexadecimal number system. (3Marks)

b) Convert $(39.D8)_{16}$ to octal. (4Marks)

c) Given the following data, evaluate y at $x = 0.6$.

x	0.1	0.3	0.5	0.7	0.9	1.1	1.3
y	0.003	0.067	0.148	0.248	0.37	0.518	0.697

(4 Marks)

d) Evaluate $\int_0^1 \frac{dx}{1+x}$ using Trapezoidal rule and □ $= 0.2$. (4 Marks)

e) Suppose that $x = \frac{5}{9}$ and $y = \frac{3}{7}$.Use five digit arithmetic to approximate $p + q$ and determine the absolute and relative errors using chopping method. (3 Marks)

f) Use bisection method to find the smallest positive root to the equation $x^3 - x - 11 = 0$ (5Marks)

g) Find the Newton-Gregory forward difference interpolating polynomial for the following data:

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.00	2.28

(4 Marks)

QUESTION TWO (20MARKS)

a) Convert the following Octal numbers into their denary equivalent;

(i) $(1547.321)_8$ (2 Marks)

(ii) $(2963.4X12)_{12}$ (2 Marks)

(iii) $(4B5.2A8)_{16}$ (2 Marks)

b) Convert the following numbers to the stated number system

(i) 0.52346_{10} to duodecimal (3 Marks)

(ii) 4592.6531_{10} to octal form (2 Marks)

(iii) 2734.426_{10} to hexadecimal form (3 Marks)

(iv) 171.976_{10} to binary form (3 Marks)

c) Convert $(01111011100100100001001 0)_2$ to octal number system. (3 Marks)

QUESTION THREE (20 MARKS)

a) Perform five iterations of the bisection method to obtain the smallest positive root of the equation

$f(x) = x^3 - 5x + 1 = 0$ (8Marks)

b) Find the approximate value of

$$I = \int_0^{\pi} sin^2 x dx$$

Using (i) Trapezoidal rule

(ii) Simpson's $\frac{1}{3} - rule$ by dividing the range of integration into six equal parts.

(12Marks)

QUESTION FOUR (20MARKS)

a) Prove the following relations

(i) $(1 + \Delta)(1 - \nabla) \equiv 1$

(4 Marks)

(ii) $(\Delta - \nabla) \equiv \Delta\nabla$.

(4 Marks)

b) Evaluate the following:

(i) $\nabla^2(ab^{cx})$ (3 Marks)

(ii) $\Delta^2(2^x)$ (3 Marks)

c) Suppose that $x = \frac{2}{7}$ and $y = \frac{1}{3}$. Use five digit chopping for calculating $x + y \; and \; x \times y$. (6 Marks)

QUESTION FIVE (20 MARKS)

a) Consider the following table of values;

x	1	1.1	1.2	1.3	1.4	1.5
$f(x)$	2	2.1	2.3	2.7	3.5	4.5

Use Newton's forward difference formula to estimate the value of $f(1.35)$. (10 Marks)

b) Obtain the polynomial for the following data:

x	1.5	2.0	2.5	3.0	3.5	4.0
f(x)	3.375	7	13.625	24	38.875	59

(10 Marks)