MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS 2022/2023

SCHOOL OF BUSINESS AND ECONOMICS

BACHELOR OF SCIENCE ECONOMICS AND STATISTICS

FOURTH YEAR SECOND SEMESTER

COURSE CODE: ECS 4205

COURSE TITLE: NUMERICAL ANALYSIS METHODS

DATE: APRIL 2023   TIME:

INSTRUCTIONS TO CANDIDATES

- **Question ONE is Compulsory**
- **Answer any other TWO questions from the remaining 4 Questions.**

QUESTION ONE (30 MARKS)

a] Prove the operator relations $\delta\mu = \dfrac{\Delta + \nabla}{2}$ where the numerical symbols have their usual

meaning **(5 marks)**

b] Obtain a relation of the form $y = ab^x$ for given data using the method of least squares.

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	127.4

(5 marks)

c] Find the root of the equation $x^3 - 3x - 5 = 0$ using Newton-Raphson method. With $x_0 = 2$

giving your answer to three decimal places **(5 marks)**

d] Use Lagrange interpolation formula to find a unique polynomial of degree two or less

such that $f(x) = 168,192,336$ at $x = 1, 7, 15$ respectively, hence evaluate $f(10)$.

(5 marks)

e] The population of a town in the decimal census was given below

Year	1921	1931	1941	1951	1961
Population in thousands	19.96	39.65	58.81	77.21	94.61

Estimate the population for the year 1963 **(5 marks)**

f] Evaluate $\displaystyle\int_1^2 \dfrac{dx}{1 + x}$ by trapezoidal rule considering eight sub-intervals

(5 marks)

QUESTION TWO (20 MARKS)

a] Show that the equation $x^3 - x - 11 = 0$ has a root between 2 and 3. Use bisection method
to get this root *(give your answer to 3 decimal places)*. **(10 marks)**

b] The following table gives corresponding values of x and y. By constructing the

difference table, find $\dfrac{dy}{dx}$ and $\dfrac{d^2 y}{dx^2}$ when $x = 1.1$

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.451	9.750	10.031

(10 marks)

QUESTION THREE (20 MARKS)

a] Use Gauss-Seidel iteration method to solve the linear systems of equations:

$$5x + 2y + z = 12$$
$$x + 4y + 2z = 15$$
$$x + 2y + 5z = 20$$

carry out four iterations correct to 4 significant figures **(8 marks)**

b] The following table gives the population of a town during the last six censuses. Estimate the increase in the population during the period from 1955 to 1958.

$Year : x$	1911	1921	1931	1941	1951	1961
$Population : y$ (*thousands*)	12	15	20	27	39	52

(12 marks)

QUESTION FOUR (20 MARKS)

a] Use Lagrange's interpolation formula to find the value of $f(2)$ given that:

x	0	1	3	4
$f(x)$	5	6	50	105

(10 marks)

b] Fit a second-degree polynomial to the following data by the method of least squares:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(10 marks)

QUESTIONS FIVE (20 MARKS)

a] Use Jacobi's iteration method to solve the linear system of equations given below:

$$5x - y + 3z = 10$$
$$3x + 6y = 18$$
$$x + y + 5z = -10$$

carry out five iterations correct to 3 decimal places with $(3, 0, -2)$ as initial approximation to the solution **(8 marks)**

b] Evaluate $\int_{4}^{5.2} \ln x \, dx$ using Simpsons $\frac{3}{8}$ rule with 6 sub-intervals **(12 marks)**