NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

**Faculty of Health, Natural Resources and Applied Sciences**

School of Natural and Applied Sciences

Department of Mathematics, Statistics and Actuarial Science

13 Jackson Kaujeua Street
Private Bag 13388
Windhoek
NAMIBIA

T: +264 61 207 2913
E: msas@nust.na
W: www.nust.na

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| QUALIFICATION : **BACHELOR OF ECONOMICS** | |
| QUALIFICATION CODE: **07BECO** | LEVEL: **5** |
| COURSE: **MATHEMATICS FOR ECONOMICS 1B** | COURSE CODE: **MFE512S** |
| DATE: **NOVEMBER 2024** | SESSION: **1** |
| DURATION: **3 HOURS** | MARKS: **100** |

**FIRST OPPORTUNITY: EXAMINATION QUESTION PAPER**

**EXAMINER:** ***Mrs. Yvonne Nkalle, Mrs. Lutopu Khoa & Mr. Tobias Kaenandunge***

**MODERATOR:** ***Mr. Ilenikemanya Ndadi***

**INSTRUCTIONS:**

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

**PERMISSIBLE MATERIALS:**

1. Non-Programmable Calculator

**This paper consists of 3 pages including this front page**

**Question 1 [10 Marks]**

Given the matrix $A = \begin{bmatrix} 3 & 2 \\ 7 & 5 \end{bmatrix}$, find "k" and "h", so that $A^2 + kI = hA$.

**Question 2 [10 Marks]**

Given $A = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ & $B = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$, Find AB.

**Question 3 [ 7 Marks]**

Solve the following system of linear equations, using matrix inversion method.

$5x + 2y = 3$

$3x + 2y = 5.$

**Question 4 [11 Marks]**

Solve the following system of linear equations, using Cramer's rule.

$x - y = 3$

$2x + 3y + 4z = 17$

$y + 2z = 7$

**Question 5 [11 Marks]**

Solve the following system of linear equations, by Gaussian elimination Method.

$4x + 3y + 6z = 25$

$x - 13 + 5y + 7z = 0$

$2x + 9y + z = 1$

**Question 6 [5 Marks]**

Solve the following inequality $-3 < 4x + 1 \leq 17.$

**Question 7 [7 Marks]**

Suppose a manufacturer of printed circuits has a stock of 200 resistors, 120 transistors and 150 capacitors and is required to produce two types of circuits. Type A requires 20 resistors, 10 transistors and 10 capacitors. Type B requires 10 resistors, 20 transistors and 30 capacitors. If the profit on that type A circuits is N$5 and that on type B circuits is N$12. Formulate a linear programming model.

**Question 8 [9 Marks]**

Find the Jacobian determinants of the following functions and evaluate it at (1,2). Conclude your answer.

$f(x, y) = x^4 + 3y^2x$

$g(x, y) = 5y^2 - 2xy + 1$

**Question 9 [10 Marks]**

Calculate the Hessian determinant at the following point (1,1), given the following function and interpret your answers.

$f(x, y) = x^2y + y^2x$

**Question 10 [20 Marks]**

Provide the solution to the following standard minimization problem, including all the steps.

Minimize C=20000 $x_1 + 25000x_2$

Subject to:

$400x_1 + 300x_2 \geq 25000$

$300x_1 + 400x_2 \geq 27000$

$200x_1 + 500x_2 \geq 30000$

$x_1;\ x_2 \geq 0.$