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 SCIENCES**

| **QUALIFICATION: BACHELOR OF ECONOMICS** | |
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| **QUALIFICATION CODE:** 07BECO | **LEVEL:** 5 |
| **COURSE CODE:** MFE511S | **COURSE NAME:** MATHEMATICS FOR ECONOMISTS 1A |
| **SESSION:** JULY 2023 | **PAPER:** THEORY |
| **DURATION:** 3 HOURS | **MARKS:** 100 |

| **SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER** | |
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| **EXAMINER** | MR G. S. MBOKOMA, MRS A. SAKARIA |
| **MODERATOR:** | MR E. MWAHI |

**INSTRUCTIONS**

1. Answer **ALL** the questions in the booklet provided.
2. Show **clearly** all the steps used in the calculations.
3. All written work must be done in **blue** or **black** ink and sketches must be done in pencil.
4. Decimal answers must be rounded to **4** decimals places

## PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

**THIS QUESTION PAPER CONSISTS OF 4 PAGES** (Including this front page)

## QUESTION 1 (30 marks)

1.1 Determine the degree of the polynomial.

$$(9x^2y^3z)^2 - \frac{6x^2y}{(y^{-3}z^{-2})^3} + 11x^4yz^6 + (4xy^2z)^3 \quad [3]$$

1.2 Simplify the following expression

1.2.1 $4x^2 - 2x(1+2x) - 2x(1-y) - 2xy$ [3]

1.2.2 $\frac{1}{5}\left[\log(a^2+9a) - \log(a+9)\right]$ [4]

1.2.3 $\frac{(p-q)^{-2mn+n^2}}{(p-q)^{(n-m)^2}} \times (p-q)^{m^2}$ [5]

1.3 Solve the following indicial equation in $x$: $\left[\left(\frac{1}{20}\right)^{2+x} \times \left(\frac{1}{20}\right)^{8x}\right]^2 = 1$ [5]

1.4 Evaluate $\lim_{x\to 2} \frac{x^3-4x}{x-2}$ [5]

1.5 Use first principle of differentiation to evaluate $\frac{dy}{dx}$ if $y = x^2 + 1$ [5]

## QUESTION 2 (25 marks)

2.1 A total cost function is given as $C = \frac{a(bh+2)}{1+dh}$ where $a, b, d$, and $h$ are quantities produced. Make $h$ the subject of the formula and then evaluate $h$ when $a = 20, c = 10$, $d = 1$ *and* $b = \frac{1}{4}$. [7]

2.2 The Investment-Savings (IS) and Liquidity Preference – Money Supply (LM) models of a certain **3-sector** economy, $Y = C + I + G$, economy compose the following:

$\boxed{IS}$

$C = 100 + 0.8Y_d;\ Y_d = Y - T$

$I = 50 - 25i$

$G = T = 50$

$\boxed{LM}$

$M^d = Y - 25i.....demand$

$\frac{M^s}{P} = 200.....supply$

Derive the $IS$ and $LM$ equations and hence determine the equilibrium levels of income and rate of interest, where $P = 2$. [8]

2.3 A firm uses labour (L) and machines (K) to manufacture their products. The cost of labour is N$ 40 per unit and the cost of using a machine is N$ 10.

2.3.1 Derive the budget line of the firm. [2]

2.3.2 Sketch a budget line for this firm, showing the combinations of (L,K) with total cost of N$ 400, label the budget line with ($C_1$). [3]

2.3.3 On the same graph, sketch another budget line with total cost of N$ 200, label it with ($C_2$) [3]

2.3.4 Discuss your observations between the two-budget lines. [2]

**QUESTION 3 (25 marks)**

3.1 A firm 's short-run production function is given by $Q = Le^{-0.02L}$.

3.1.1 Find the marginal product of labour? [5]

3.1.2 At $L = 50$, determine whether the firm's maximes its production level? [3]

3.1.3 What will be the production output at $L = 50$ ? [3]

3.2 The daily production function of a small-scale shoe manufacturer is given by $Q = \sqrt[3]{3K^2 + 2L^3}$ , where $L$ is the labour input measured in daily work hours and $K$ is the cost of capital investment measured in thousands of dollars and $Q$ represents the daily production of shoes.

3.1.1 Determine the **marginal productivity of capital** and the **marginal productivity of labour** [4]

3.1.2 Calculate the MRTS of the productions of shoes if workers put in 8 hours per day and cost of capital is N$ 4. [5]

3.3 Determine $\frac{dy}{dx}$, if $2x^3 - 3y^2 + 7xy = 0$ [5]

**QUESTION 4 (20 marks)**

4.1 Determine the following integrals:

4.1.1 $\int \left( \frac{x^3 + 2x^2 - 4x + 1}{\sqrt{x}} \right) dx$ [5]

4.1.2 $\int_{-2}^{3} e^{\frac{-x}{2}} dx$ [5]

4.2 The revenue and cost rates of a mining exploratory company are $R'(t) = 14 - t^{\frac{1}{2}}$ and $C'(t) = 2 + 3t^{\frac{1}{2}}$ respectively, where the time $t$ is measured in years and $R$ and $C$ are measured in millions of dollars.

4.2.1 How long should the exploration be continued to obtain the maximum profit? [4]

4.2.2 Calculate the maximum profit for this company. [6]

.....END OF EXAMINATION.....