NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: BACHELOR OF ECONOMICS	
QUALIFICATION CODE: 07BECO	**LEVEL:** 5
COURSE CODE: MFE511S	**COURSE NAME:** MATHEMATICS FOR ECONOMISTS 1A
SESSION: JULY 2022	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER	
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MODERATOR:	MR I.D.O NDADI

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 (25 marks)

1.1 For each of the following statements, indicate whether True (T) or False (F)

1.1.1 $\sqrt{\sqrt{(x-2)}} = |(x-2)|$ [1]

1.1.2 $\log_b\left(\frac{x}{b}\right) = \log_b x - 1$ [1]

1.1.3 $\lim_{\delta \to 0} 5 = 5$ [1]

1.1.4 If $a^2 + b^2 = 1$ and $x^2 + y^2 = 2$, then $(ax + by)^2 + (ay - bx)^2 = 2$ [1]

1.1.5 $Q = 0.001K^{0.23}L^{0.76}$ is a strict Cobb-Douglas production function [1]

1.2 Determine the degree of the polynomial.

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

1.3 Simplify the expression $\frac{(a+b)^2 - c^2}{a^2 + ab + ac + bc} \times \frac{a^2 + ab - ac - bc}{a + b + c} \div \frac{2a^2 - ac - c^2}{a^2 - c^2}$ [5]

1.4 Solve the following indicial equation in x : $\left[\left(\frac{1}{20}\right)^{2+x} \times \left(\frac{1}{20}\right)^{8x}\right]^2 = 1$ [4]

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

1. 6 Use first principle of differentiation to evaluate $\frac{dy}{dx}$ if $y = x^{-1}$ [5]

QUESTION 2 (30 marks)

2.1 Assume an income tax $\boldsymbol{T}$ with a proportional component $\boldsymbol{t}$ incorporated into an income determination model $Y = C + I$,

$$C = C_0 + bY_m\,,\ T = T_0 + tY,\ Y_m = Y - T,\ I = I_0$$

where $C_0 = 42$, $I_0 = 15$, $T_0 = 10$, $b = 0.375$ and $t = 0.2$

2.1.1 Determine the reduced form of this model [5]

2.1.2 Determine the numerical value of Y [2]

2.2 Given that $Q_s = -5 + 3p$ and $Q_d = 10 - 2p$, determine the equilibrium price and quantity [5]

2.3 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]

2.4 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.

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

2.4.2 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]

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

2.4.4 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 Given the production

$$Q = K^2 + 2L^2$$

3.2.1 Determine the marginal products of $\frac{\partial Q}{\partial K}$ and $\frac{\partial Q}{\partial L}$ [4]

3.2.2 Show that $MRTS = \frac{2L}{K}$ and $K\frac{\partial Q}{\partial K} + L\frac{\partial Q}{\partial L} = 2Q$ [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 $\int \sqrt{t}\, dt$ [3]

4.1.2 $\int_0^5 e^{-2x}\, dx$ [5]

4.2 Assume that the rate of an investment is given by the function $I(t) = 6\sqrt{t}$. Compute the total capital accumulation (K) between the 1st and 5th years? [**Hint**: $K = \int I(t)dt$] [6]

4.3 The marginal revenue of a company is given $MR = 100 + 20x + 3x^2$, where x is an amount of good in units sold for a period. Find the total revenue function at $(x = 2)$ when total revenue is equal to 260? [6]

.....END OF EXAXAMINATION.....