NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF MANAGEMENT SCIENCES

DEPARTMENT OF ACCOUNTING, ECONOMICS AND FINANCE

QUALIFICATION: BACHELOR OF ECONOMICS	
QUALIFICATION CODE: 12BECO	**LEVEL:** 7
COURSE CODE: MEC712S	**COURSE NAME**: MATHEMATICAL ECONOMICS
SESSION: NOVEMBER 2023	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	**MR EDEN TATE SHIPANGA**
MODERATOR:	**DR R. KAMATI**

INSTRUCTIONS
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. PEN,
2. PENCIL
3. CALCULATOR

THIS QUESTION PAPER CONSISTS OF 2 PAGES (Including this front page)

Question 1 [25 Marks]

1. Solve the following system of equations using Cramer's rule **(15)**

a)

$$8X_1 - X_2 = 16$$
$$2X_2 + 5X_3 = 5$$
$$2X_1 - 3X_3 = 7$$

b)

$$7X_1 - 3X_2 - 3X_3 = 7$$
$$2X_1 + 4X_2 + 3X_3 = 0$$
$$-2X_2 - X_3 = 2$$

2. Use Jacobian determinants to test the existence of functional dependence between the paired functions.

a)

$y_1 = 3x_1^2 + x_2$
$y_2 = 9x_1^4 + 6x_1^2(x_2 + 4) + x_2(x_2 + 8) + 12$ **(5)**

b)

$y_1 = 3x_1^2 + 2x_2^2$
$y_2 = 5x_1 + 1$ **(5)**

Question 2 [25 Marks]

In a three–industry economy, it is known that industry I uses 20 cents of its own product, 10 cents of commodity III and 60 cents of commodity II to produce a dollar's worth of commodity I industry II uses 10 cents of its own product , 30 cents of commodity III and 50 cents of commodity I to produce a dollar's worth of commodity II while industry III uses none of its own product and commodity I, but uses 20 cents of commodity II in producing a dollar's worth of commodity III; and the open sector demands N$ 1,000 billion of commodity I, N$ 2,000 billion of commodity II and 500 billion of commodity III

a) Write out the input matrix, and the specific input matrix equation for this economy. **(5)**

b) Find the solution output levels? **(15)**

c) Work out the required primary input for this economy **(5)**

Question 3 [25 Marks]

1. Optimise the following function, using a) Cramer's rule for the first order condition and b) the Hessian for the second-order condition: **(10)**

$y = 5x_1^2 - 7x_1 - x_1x_2 + 8x_2^2 - 6x_2 + 4x_2x_3 + 6x_3^2 + 4x_3 - 5x_1x_3$

2. Maximize utility $u = xy + x$, subject to the budget constraint $6x + 2y = 110$ by a) finding the critical values $\bar{x}$, $\bar{y}$ and $\bar{\lambda}$, b) use the Hessian bordered. **(15)**

Question 4 [25 Marks]

Maximise profits using Kuhn-Tucker conditions, $\pi = 54x - x^2 + 76y - 3y^2 - 12$ subject to the production constraint $x + y \leq 35$ **(25)**

TOTAL MARKS: 100