



**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 2024	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]

Given α is non-income tax, β is income tax, δ is marginal propensity to consume, γ is autonomous consumption, Y (national income), I_0 (investment) and G_0 (government expenditure)

1. Formulate the equations needed to find the reduced form of equilibrium income (Y_e). (5)
2. Do a comparative static to find the effect of income tax, non-income tax and government spending on equilibrium income. (15)
3. If $\beta = 0.2$; $\alpha = 20$; $\gamma = 80$; $\delta = 0.25$; $I_0 = 45$; $G_0 = 50$, find the effects of lump sum tax increase by \$1 billion?(5)

Question 2 [25 Marks]

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

$$X_1 = 0.2X_1 + 0.3X_2 + 0.2X_3 + 10$$

$$X_2 = 0.4X_1 + 0.1X_2 + 0.2X_3 + 5$$

$$X_3 = 0.1X_1 + 0.3X_2 + 0.2X_3 + 6$$

2. Solve the following system of equations using Cramer's rule (10)

$$8X_1 - X_2 = 16$$

$$2X_2 + 5X_3 = 5$$

$$2X_1 - 3X_3 = 7$$

Question 3 [25 Marks]

1. In a three-industry economy, it is known that industry I uses 30 cents of its own product, 40 cents of commodity III and 20 cents of commodity II to produce a dollar's worth of commodity I. Industry II uses 15 cents of its own product, 35 cents of commodity III and 45 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 25 cents of commodity II in producing a dollar's worth of commodity III. The open sector demands N\$ 1,000 billion of commodity I, N\$ 800 billion of commodity II and 1200 billion of commodity III.
 - a) Write out the input matrix, and the specific systems of equations for this economy. (5)
 - b) Find the solution output levels by Cramer's rule. (15)
 - c) Work out the required primary input for this economy (5)

Question 4 [25 Marks]

1. Optimise the following function, a) find the critical value for the first order condition and b) the high-order Hessian:
$$y = 4x_1^2 - 7x_1 - x_1x_2 + 8x_2^2 - 5x_2 + 2x_2x_3 + 4x_3^2 + 2x_3 - 4x_1x_3$$
 (15)
2. Use discriminants to determine whether each of the following quadratic function is positive or negative definite:
 - a) $y = 5x_1^2 - 6x_1x_2 + 3x_2^2 - 2x_2x_3 + 8x_3^2 - 3x_1x_3$ (5)
 - b) $y = x_1^2 + 6x_2^2 + 3x_3^2 - 2x_1x_2 - 4x_2x_3$ (5)

TOTAL MARKS: 100