(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN EXAMINATION

UNIVERSITY EXAMINATIONS 2023/2024 ACADEMIC YEAR

FIRST YEAR, SECOND SEMESTER EXAMINATIONS

FOR BACHELOR OF ECONOMICS/ECOSTAT

COURSE CODE: ECO 104

COURSE TITLE: MATHEMATICS FOR ECONOMIST II

DATE: TUESDAY 16th April 2024 **TIME:** 11:30-14:30

INSTRUCTIONS TO CANDIDATES

ATTEMPT QUESTION **ONE** AND ANY OTHER **TWO** (Question one carries 30 marks and the rest 20 marks each)

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE

a) Distinguish between dynamic optimization and static optimization (4marks)

b) i) Find the second order total differential and show the matrix notation

$$Z = 5X^2 - 6XY - 3Y^2$$ (5marks)

ii) Compute dz and d^2z for

1. $Z = X^4Y^2$ (4marks)
2. $Z = 2U^3V^6$ (4marks)

c) Maximize or minimize the following functions subject to their constraints

$$Z = 10X - X^2 + 4Y - 2Y^2 + XY$$

Subject to $2X + 3Y = 3100$ (5marks)

d) Consider the following Cobb Douglas production function

$$Q = AK^{\alpha}L^{\beta}$$

Show the relationship between MPL and APL (4marks)

e) If inverse demand is P=2-0.13Q, what is price elasticity if the price is 1.2 .Is the demand elastic, inelastic or unit elastic? (4marks)

QUESTION TWO

a) Given the matrix of technical coefficients, A and the final demand D, for industries 1, 2 and 3

$$A = \begin{bmatrix} 0.1 & 0.1 & 0 \\ 0.2 & 0.5 & 0.2 \\ 0.1 & 0.4 & 0.6 \end{bmatrix}$$

$$D = \begin{bmatrix} 120 \\ 200 \\ 700 \end{bmatrix}$$

Required, determine $[1\text{-}A]^{-1}$ and the total output required for each sector (20marks)

QUESTION THREE

a) Explain the properties of definite integrals (5marks)

b) Cobb Douglas production function is typically written as

$$P = AL^{\beta}L^{1-\beta}$$

Show that $\frac{\delta P^{1-\beta}}{\delta K} = \frac{P}{K}$ (15marks)

QUESTION FOUR

i) A firm is a monopolistic producer of two goods G^1 and G^2. The price are related to quantities Q_1 and Q_2 according to the demand equations;

$P_1=50-Q_1$

$P_2=95-3Q_2$

If the total cost function is $TC=Q_1^2+3Q_1Q_2+Q_2^2$

a) Find the value of Q_1 and Q_2 that maximize profits and deduce the corresponding price and profit. (10marks)

b) State whether the critical values of Q_1 and Q_2 give rise to a maximum or minimum (3marks)

ii) Show the equilibrium of the consumer in this constrained function

Max=U(x, y)

S.t $Px^x + Py^y = B$ (7marks)

QUESTION FIVE

a) Discuss the importance of mathematics in economic analysis (6marks)

b) Given the following $Q=AK^{2/5}L^{2/5}$, find the degree of homogeneity and state whether the function displays constant, increasing or decreasing returns to scale (6marks)

c) Determine returns to scale for the following production functions

i) $Q=AL^{1/2}K^{1/4}$ (4marks)

ii) $Q=AL^{0.6}K^{0.4}$ (4marks)