



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
MAIN EXAMS**

**FOR THE BACHELOR DEGREE OF
ECONOMICS AND ECONOMIC AND STATISTICS
FIRST YEAR SECOND SEMESTER EXAMINATIONS**

COURSE CODE: ECO 104

COURSE TITLE: MATHEMATICAL ECONOMICS II

DATE:

TIME:

INSTRUCTIONS TO CANDIDATES

ATTEMPT QUESTION ONE AND ANY TWO QUESTIONS

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

a) The demand function for a commodity is given by the following

$$P = 50 - 0.5 Q$$

The cost of producing the commodity is made up of fixed cost of 200 shillings and variable cost of 0.2 shillings per unit.

- i) Find the profit function (π) for the commodity (4mks)
- ii) Determine the output level at which $\frac{d\pi}{dQ} = 0$ (5mks)

b) You are given the following production function:

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

Where Q is output, L and K are, respectively, labour and capital inputs, and A , α and β are constants.

- i) Determine the average product of labour and the average product of capital. (4mks)
- ii) Express the **APL** in terms of Q and L and **APK** in terms of Q and K (4mks)
- iii) Find the **MPL** and **MPK**.
Express these marginal products in terms of Q, K and β (in case of **MPL**) and Q, L and α (in case of **MPK**) (3mks)
- iv) Compare the magnitudes of **APL** and **MPL**. Comment on your results. (3mks)

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- i) Distinguish between integrand and integral (4 marks)
- ii) List any three examples of static equilibrium (3 marks)

QUESTION TWO (20 MARKS)

a) The products of three different motor vehicle companies are represented by the following matrix.

<i>company 1</i>	<i>company 2</i>	<i>company 3</i>	
3	10	0	<i>Saloons</i>
7	2	5	<i>Pick-ups</i>
0	1	15	<i>Trucks</i>
6	0	13	<i>Buses</i>

- i) State the company that has no buses (2mks)
- ii) How many pick-ups do the companies have in total? (3mks)
- iii) How many saloons does company 3 have? (3mks)
- iv) How many saloons and trucks does company 2 possess? (3mks)

b) Consider the following matrices:

$$A = \begin{bmatrix} 3 & 4 & 6 \\ 2 & 1 & 5 \\ 11 & 0 & 7 \\ 1 & 9 & 3 \end{bmatrix}$$

$$B = \begin{bmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \\ \dots & \dots & \dots & \dots \\ b_{m1} & b_{m2} & \dots & b_{mn} \end{bmatrix}$$

$$D = [d_{ij}] \quad \begin{array}{l} i = 1, 2, \dots, k \\ j = 1, 2, \dots, r \end{array}$$

- i) State the order of each of the matrices. (3 mks)
- ii) What are the dimensions of **B**? (2mks)
- iii) How many rows and columns does **D** have? (2mks)
- iv) What type of matrix is matrix **B** (diagonal? Square? Or what?). (2mks)

QUESTION THREE (20 MARKS)

a) Given the following optimization problem:

$$\begin{array}{ll} \text{Optimize} & z=xy \\ \text{Subject to} & 2x+y=4 \end{array}$$

- i) Write out the Lagrangian function for the problem. (3mks)
- ii) Find the critical values of **x**, **y** and λ (9mks)
- iii) Find the stationary value of **z**. (2mks)
- iv) Determine whether the stationary value of **z** presents a maximum or a minimum, by applying the second – order condition. (2mks)

QUESTION FOUR (20 MARKS)

a) you are given the following marginal revenue functions

$$MR = 2 + \frac{1}{4} Q$$

$$MR = 3 - 2Q + Q^2$$

$$MR = 20 + 3Q + Q^2$$

$$MR = (4)\sqrt{Q}$$

For each of the marginal revenue functions, determine:

- i) The corresponding total revenue function. (5mks)
- ii) Total revenue for an output of $Q=4$. (5mks)
- iii) b) The marginal propensity to consume for some economy is 0.68. Determine the consumption function for the economy given that, consumption $C = 9$ when national income $y = 0$. (5mks)

QUESTION FIVE (20 MARKS) .

a) What do you understand by the following (6 marks)

- i. A matrix
- ii. Comparative statics
- iii. Input –output analysis

b) Outline the assumptions of input – output model (6marks)

c) A firm produces two products q_1, q_2 with its profit (π) defined as

$(\pi) = 5q_1 + 3q_2$. If the firm maximizes its profit subject to the following constraints

$$6q_1 + 2q_2 \leq 26$$

$$5q_1 + 5q_2 < 40$$

$$2q_1 + 4q_2 < 28$$

$$q_1, q_2 > 0$$

Using simplex algorithm ,determine q_1, q_2 that will maximize profit and the optimal profit of the firm (8 marks)