LAIKIPIA UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST SEMESTER 2025/2026 ACADEMIC YEAR

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF COMMERCE

BCOM -114: BUSINESS MATHEMATICS

STREAM: ***BCOM*** ***TIME: 2 HRS***

DAY: TUESDAY [14.30 P.M-16.30 P.M] ***DATE: 03/02/2026***

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

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INSTRUCTIONS:

1. **QUESTION ONE (1) IS COMPULSORY (30 MARKS)**
2. **ANSWER ANY OTHER TWO (2) QUESTIONS (20 MARKS EACH)**

QUESTION ONE

a) A survey was conducted on the newspaper readership of 3 dailies: the Mirror, the Citizen and the Times, M, C, T respectively and the following data was obtained:

The number of people who read M, C & T was found to be 55, 45, and 39 respectively.
The number that read M & T = 19
The number that read C & M = 15
The number that read C & T = 14
Those who read all the 3 were found to be 4 people only.

Required

Determine the number of people who:

i) Read the Mirror only. **(4 Marks)**

ii) Read Citizen or Times but not the Mirror **(4 Marks)**

iii) The total number of people interviewed if 5 people read none of the papers. **(4 Marks)**

b) Consider Kenya has a closed economy of three sectors characterised by the following activity levels and trade flows:

$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} = \begin{bmatrix} 100 \\ 200 \\ 100 \end{bmatrix}, \begin{bmatrix} x_{11} & x_{12} & x_{13} \\ x_{21} & x_{22} & x_{23} \\ x_{31} & x_{32} & x_{33} \end{bmatrix} = \begin{bmatrix} 10 & 30 & 10 \\ 30 & 50 & 20 \\ 10 & 20 & 20 \end{bmatrix}, \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} = \begin{bmatrix} 50 \\ 100 \\ 50 \end{bmatrix}$$

Required

i) Construct the complete input–output table, including a row for the value added to each sector by factor services, and confirm that the various accounting identities have been observed in the construction of the table **(5 Marks)**

ii) Construct the technological matrix A of input–output coefficients and the Leontief matrix I–A **(2 Marks)**

iii) Imagine the vector of final demands for next year is estimated to be:

$y = [y_1 \quad y_2 \quad y_3]' = [60 \quad 120 \quad 60]'$, find out the corresponding activity levels in

$x = [x_1 \quad x_2 \quad x_3]'$ **(5 Marks)**

c) Liam deposited Ksh. 800,000 in a savings account for 4 years at a compound interest rate of 12% p.a. Calculate the accumulated amount if compounding is done

i) Semi-annually **(3 marks)**

ii) Quarterly **(3 marks)**

QUESTION TWO

a) Kenya's Wildlife Service is considering two new machines that should produce considerable cost savings in its operations. The cost of each machine is KSh. 14, 000 and neither is expected to have a salvage value at the end of a 4-year useful life. The KWS's required rate of return is 12% and it prefers that a project return its initial outlay within the first half of the project's life. The annual after-tax cash savings for each machine are provided in the following table:

Year	**Machine A (KSh.)**	**Machine B (KSh.)**
1	5,000	8,000
2	5,000	6,000
3	5,000	4,000
4	5,000	2,000
Total	20,000	20,000

Required

i) Compute the payback period for each machine **(5 Marks)**

ii) Compute the net present value for each machine **(5 Marks)**

iii) Which machine should be purchased? **(2 Marks)**

b) A house is to be sold either on cash basis or through a loan. The cash price is Ksh 750, 000. The loan conditions are as follows: there is to be down payment of 10% of the cash price and the rest of the money is to be paid through a loan at 10% per annum compound interest. A customer decided to buy the house through a loan.

i) Calculate the amount of money loaned to the customer. **(5 Marks)**

ii) The customer paid the loan in 3year's. Calculate the total amount paid for the house **(3 Marks)**

QUESTION THREE

a) A company produces a product which it sells for Ksh.6, 000 per unit. Each unit cost Ksh.1500 in variable expenses, and fixed costs on an annual basis are Ksh.4, 000,000. If q equals the number of units produced and sold during the year

i) Formulate the linear cost function **(2 Marks)**

ii) Formulate the linear revenue function **(2 Marks)**

iii) Formulate the linear profit function **(2 Marks)**

iv) What does annual profit equal to, if 100,000 units are produced and sold during the year? **(2 Marks)**

v) What level of output is required in order to earn zero profit? **(2 Marks)**

b) The company estimates that the demand for its product fluctuates with the price it charges. The demand function is Q = 230,000 – 350P; Where Q equals the number of units demanded and P equals the price in Kenya shillings. The total cost of producing Q units of the product is estimated by the function $C = 460{,}000 + 360Q + 0.0016Q^2$

i) Determine how many Q units should be produced in order to maximize annual profit **(5 Marks)**

ii) What price should be charged? **(3 Marks)**

iii) Calculate the expected annual profit **(2 Marks)**

QUESTION FOUR

a) Laikipia University Enterprise Limited produces two items, Mineral Water (X) and Fresh Milk (Y). Each unit of X requires in its production 30 units of raw material A and 15 units of raw material B. Each unit of Y requires 45 units of raw material A and 75 units of raw material B. There is a limited supply of only 1800 units of raw material A and 1425 units of raw material B.

Required:

i) An equation, which expresses the number of units of X and Y that can be produced using 1800 units of raw material A. **(3 Marks)**

ii) An equation which expresses the number of units of X and Y that can be produced using exactly 1425 units of raw material of B. **(3 Marks)**

iii) By solving equations obtained in parts (i) and (ii) simultaneously, determine the number of units of X and Y which can be produced by using exactly 1800 units of raw material A and exactly 1425 units of raw material B. **(4 Marks)**

iv) Suppose the unit prices of X and Y are Sh. 10,000 and Sh. 7,000 respectively whereas their respective variable production costs per unit are Sh. 5,000 and Sh. 4,900. Further, their combined fixed costs are Sh. 50,000.Determine the total profit that Laikipia University Enterprise Limited will make given production levels obtained in part **(iii)** above. **(4 Marks)**

b) Assume that a manufacturer average cost equation is given as:

$$C = 0.0001Q^2 - 0.02Q + 5 + \frac{500}{Q}$$

i) Find the marginal cost function. **(3 Marks)**

ii) What is the marginal cost when 50 units are produced? (**3 Marks)**

QUESTION FIVE

a) Mr. James borrowed Ksh.560, 000 from a bank to buy a piece of land. He was required to repay the loan with simple interest for a period of 48 months. The Repayment amounted to Ksh.21, 000 per month. Calculate

i) The interest paid to the bank **(5 Marks)**

ii) The rate per annum of the simple interest **(5 Marks)**

b) Three business partners, Nana, Wawa and Kiki contributed Ksh.100, 000, Ksh. 185,000 and Ksh.205, 000 respectively. They agreed to put 40% of the profit back into business each year. They also agreed to put aside 40% of the remaining profit to cater for taxes and insurance. The rest of the profit would then be shared among the partners in the ratio of their contributions. At the end of the first year, the business realized a gross profit of Ksh. 800,000.

i) Calculate the amount of money Kiki received more than Nana at the end of the First year **(5 Marks)**

ii) Wawa further invested Ksh. 125,000 into the business at the beginning of the Second year. Given that the gross profit at the end of the second year increased in the ratio 10:9, calculate Wawa's share of the profit at the end of the second year **(5 Marks)**