

CHUKA

UNIVERSITY



**UNIVERSITY EXAMINATIONS**  
**CHUKA/NAIROBI/WAJIR CAMPUS**

**EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF  
PROCUREMENT AND LOGISTICS MANAGEMENT AND BACHELOR OF  
AGRIBUSINESS MANAGEMENT**

**BPLM 102: MANAGEMENT MATHEMATICS**

**STREAMS: BPLM, AGBM (ODEL)**

**TIME: 2HOURS**

**DAY/DATE: MONDAY 14/04/2025**

**8.30 A.M. – 10.30 A.M.**

**INSTRUCTIONS**

**Answer Question ONE and any other TWO questions**

**QUESTION ONE (30 MARKS)**

(a) Explain the following mathematical concepts

- (i) Ordinary Annuity
- (ii) Annuity due
- (iii) Equal sets
- (iv) Finite set
- (v) Market equilibrium (10 marks)

(b) Three sets X, Y and Z are defined on a universal set  $U = \{1, 2, 3, \dots, 15\}$ . Given that  $X = \{1, 3, 5, 7, 9\}$ ;  $Y = \{2, 4, 6, 7\}$  and  $Z = \{1, 4, 7, 12, 13\}$

- i. Represent the sets on a Venn diagram (4 marks)
- ii. Determine the composition of the following sets
  - a.  $X \cap Y \cap Z$  (2 marks)
  - b.  $n\{X \cup Y \cup Z\}$  (2 marks)
  - c.  $Z - (X \cap Y)$  (2 marks)

(c) Given that the supply function of an item is  $q = p^2 - 400$  while the demand function is given by  $q = p^2 - 4p + 2600$ . Determine quantity at which market equilibrium occurs. (6 marks)

(d) A firm produces energy saving cookers and sells them for Sh. 2500 each. The total cost of production comprises a fixed cost of Sh. 400,000 plus variable cost of Sh.500 per every cooker produced and sold. Let Q be the as the number of cookers produced and sold and assume that the total cost and total revenue functions are linear. Required:

(i) Write down the Revenue function (2 marks)

(ii) Determine the level of output at which total revenue will be equal to total cost (2 marks)

(e) A fixed deposit of Sh.200,000 at Absa bank earns a compound interest at 12% p.a compounded annually for a period of four years. What is the accumulated amount at the end of the holding period? (4 marks)

### QUESTION TWO (20 MARKS)

(a) Explain the following terms as used in mathematics of finance

(i) Simple Interest (2 mark)

(ii) Compound Interest (2 marks)

a) Given function  $\frac{dy}{dx} = 0.02x^3 - 0.4x^2 + 5x + 150$ .

Write down the second derivative function (2 marks)

b) Faulu Kenya provides credit solutions to borrowers in need of financial services. A trader wishes to borrow Ksh.350,000 at the prevailing interest rate of 9% per annum. The loan is to be repaid in 6 equal annual instalments. Determine:

(i) Determine the amount of annual repayment needed to amortize this loan. (3 marks)

(ii) Prepare the amortization schedule to show loan balance after three years of repayment. (3 marks)

(c) The total cost (TC) and Total Revenue (TR) functions for a product are

$$AC = 40,000 + 25Q + 0.025Q^2 \text{ While } TR = 75Q - 0.008Q^2$$

(i) Determine the total cost function (2 mark)

(ii) What quantity should be produced and sold to maximize profit? (6 marks)

### QUESTION THREE (20 MARKS)

(a) A firm has analyzed their operating conditions, prices and costs and has developed the following functions: Total Revenue =  $200q - 2q^2$  and Marginal cost =  $50 + 2q$  where Q is the number of units sold. Total cost is Ksh.700 when 10 units are produced and sold. Determine:

- i. The total cost function (4 marks)
  - ii. Profit function (2 marks)
  - iii. Profit when quantity produced is 20 units (2 marks)
- (b) A bookstore owner will buy 20 books if the price is Sh.1,200 per book and 60 books if the price is Sh.400 per book. The supplier of the books is willing to provide 70 books if the price is Sh.1,300 per book but only 15 books if the price is Sh.300 per book.
- Assuming the supply and demand functions for the books are linear
- i. Derive the linear equations for the demand and supply functions (5 mark)
  - ii. At what point will the market equilibrium occur? (3 marks)
- (c) The formula  $A = 22.9e^{0.0183t}$  models the population of Kenya, where  $A$  is the population in millions,  $t$  years after 2015.
- i. Estimate the population in 2020 (3 marks)
  - ii. After how many years will the population reach 30 million (3 marks)

#### QUESTION FOUR (20 MARKS)

- (a) Highlight the role of management mathematics in management (5 marks)
- (b) A person to save for his child's education. He wants to save sh.5,000 at end of every year for the next 10 years, starting from today. Assuming an annual interest rate of 6%, How much would he have accumulated at the end of 10 years? (5 Marks)
- (c) Consider the analysis of data on farmers in TN county. It was found that 130 grew maize, 90 grew Coffee, 84 grew Tea, 40 grew Maize and Tea, 30 grew Coffee and Tea, 50 grew Maize and Cofee while 16 grew all the three crops. Suppose 119 farmers were not engaged in any of the three crops. Let M, C and T denote sets of farmers growing Maize, Coffee and Tea respectively.
- (i) Represent the data using a Venn diagram (4 marks)
- Find the number of farmers:
- (ii) Who were actually involved in the survey (2 marks)
  - (iii) Growing exactly one crop (2 marks)
  - (iv) Growing exactly two crops (2 marks)