KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

MAIN CAMPUS

FIRST YEAR EXAMINATIONS FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE (ECONOMICS AND STATISTICS)

FIRST SEMESTER (2023 / 2024)

(SEPTEMBER-DECEMBER 2023)

BECS / ECON 130: INTRODUCTION TO MATHEMATICS FOR ECONOMISTS

STREAM: Y1S1 TIME: 2 HOURS

DAY: DATE:

INSTRUCTIONS

1. Do not write anything on this question paper.
2. Answer **Question ONE (compulsory**) and any other **TWO** questions.
3. Question ONE carries 30 marks, while every other question contains 20 marks each.

QUESTION ONE (COMPULSORY – 30 MARKS)

a) Given the sets $A = \{2, 4, 6\},\ B = \{7, 2, 6\},\ C = \{4, 2, 6\},\ D = \{2, 4\}$, say whether the following are false or true.

i) $A = D$

ii) $6 \in C$

iii) $\emptyset \in C$

iv) $C = A$ (2 marks)

b) A sample of 100 Young Christian Union voters revealed the following concerning three candidates; Ali, Bungei and Chiru who were running for the Y.C.S Party Chairman, Secretary and Treasurer respectively.

14 preferred both Ali and Bungei
49 preferred Ali or Bungei but not Chiru
21 preferred Bungei but not Chiru or Ali
61 preferred Bungei or Chiru but not Ali
32 preferred Chiru but not Ali or Bungei
7 preferred Ali and Chiru but not Bungei

i) With the aid of a Venn diagram, determine the number of voters that were in favour of all three candidates (assume that every member of Y.C.S voted for at least one candidate). (4 marks)

ii) Determine the candidate that went unopposed if a rule of 50% majority were used in such a decision. (2 marks)

c) Derive a function for Marginal Revenue for the demand schedule below:

$$p = \frac{720}{(25+q)^{0.5}}$$

(4 marks)

d) Use Gauss Elimination to solve the following system of linear equations:

$$2x + y - z = 10$$
$$x - 2y + 3z = 14$$
$$2x - 2y - z = 9$$

(5 marks)

e) Find the derivative of the following function:

$$y = x^{-4}\,(5 + 7x^{-3})$$

(4 marks)

f) Evaluate the following integrals:

i) $\int \frac{5}{3-2x}\,dx$ (3 marks)

ii) $\int_5^6 (6x^{0.5} - 3x^{-2} + 85x^4)dx$ (3 marks)

g) Find the consumer and producer surplus given the demand function $2P = 60 - Q$ and the supply function $P = 12 + 4Q$. (3 marks)

QUESTION TWO (20 MARKS)

a) Briefly discuss the use of matrices in economics. (2 marks)

b) Given the following matrix:

$$\boldsymbol{A} = \begin{pmatrix} 1 & 3 & 4 \\ 2 & 2 & 1 \\ 3 & -3 & 9 \end{pmatrix}$$

i)Find all the minors and cofactors of matrix **A.** (4 marks)
ii) Use i) to find the determinant $\det(\boldsymbol{A})$ (2 marks)

c) For the demand schedule $p = 40 - 0.5q$, find the value of Marginal Revenue (MR) when $q = 15$. (3 marks)

d) Given the demand function $q = (1200 - 2\,p)^{0.5}$, what is the elasticity of demand when quantity is 30? (4 marks)

e) If a firm faces the Marginal Cost Schedule: $MC = 180 + 0.3q^2$ and the Marginal Revenue Schedule: $MR = 540 - 0.6q^2$ and total fixed costs are $ 65. What is the maximum profit it can make? (Assume that second-order conditions are met.)

(5 marks)

QUESTION THREE (20 MARKS)

a) Use Gauss-Jordan elimination to solve the following system of linear equations:

$$x_1 - 2x_2 + 3x_3 = 11$$
$$2x_1 - x_2 + 3x_3 = 10$$
$$4x_1 + x_2 + 4x_3 = 4$$

(6 marks)

b) Find the derivatives of the following function:

$$y = \frac{(3x + 0.4x^2)}{(8 - 6x^{1.5})^{0.5}}$$

(5 marks)

c) Given the non-linear demand schedule $p = 600 - 6q^{0.5}$ and the corresponding Marginal Revenue function $MR = 600 - 9q^{0.5}$, use definite integrals to find:

i)the total revenue when $q = 2500$. (2 marks)

ii) the change in total revenue when q increases from 2025 to 2500.

(3 marks)

d) A firm notices that its total production costs are $ 3200 when output is 85 and $ 4820 when output is 130. If total cost is assumed to be a linear function of output, what expenditure will be necessary to manufacture 175 units? (4 marks)

QUESTION FOUR (20 MARKS)

a) Given $TC = 0.5\ q^3 - 3q^2 + 25\ q + 20$, derive the functions for the following:

i)Marginal Cost (MC) (2 marks)

ii) Average Cost (AC) (2 marks)

iii)The slope of Average Cost (AC) (1 mark)

b) A firm's total revenue and total cost functions are:

$$TR = 52q - q^2$$
$$TC = \frac{q^3}{3} - 2.5\ q^2 + 34q + 4$$

At what output will profit be maximised? (4 marks)

c) 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.

Using a Venn diagram, determine the number of people who:

i)Read the Mirror only. (2 marks)

ii) Read Citizen or Times but not the Mirror. (3 marks)

iii)The total number of people interviewed if 5 people read none of the papers. (2 marks)

d) Evaluate the following indefinite integral:

$$\int \frac{\sin(\ln x)}{x}\, dx$$

(4 marks)

COURSE OUTLINE OF ECON 130 / BECS 130: Introduction to Mathematics for Economists

Course title: Introduction to Mathematics for Economists

Course code: ECON 130 / BECS 130

Year and semester: Year 1 Semester 1
Pre-requisite: None
Contact hours: 45 **Course lecturer**: Dr. Songa, M.A

Purpose of the course: Introduces the learner to various aspects of application areas of mathematics to economic analysis.

Objectives of the course:

- Empower the learner with a working knowledge of differential and integral applications to economic analysis such as demand and supply.
- The student should be able to solve systems of linear equations by the end of thiscourse.

Course content:

Mathematics and Economic Analysis. Set Theory. Functions. Equations and Inequalities. Differentiation and Integration. Optimization. Exponents and Logarithms. Roots. Binomial Expansions. Linear Algebra Matrices.

Course Outline:

Week	Course Content	Topics
Week 1	Mathematics and Economic Analysis	• Introduction to Mathematical Economics • Why StudyMathematics • Mathematical versus non-mathematical economics
Week 2	Set Theory	• Setnotation • Relationships betweensets • Operations onsets • Laws of setoperations
Week 3	Functions	• Linear Univariate functions &application toeconomics • Univariate non-linear functions &applications • Multivariatefunctions • Composite functions, Constant functions,polynomials, • The Cobb-Douglas productionfunction

Week 4	Equations and Inequalities	• Solving LinearEquations • Solving quadraticequations • Graphicalsolutions • Solving unequalentities
Week 5	Differentiation	• Definitions • Differentiation by firstprinciple

Week 6	Differentiation	• Rules of differentiation (Constant rule, product rule, power rule, quotientrule)
Week 7	Integration	• Indefiniteintegral • Definiteintegral • Rules of integration (Power rule and substitutiononly) • Applications of integrals to economic situations.
Week 8	Optimization	• Derive marginal revenue and marginal costfunctions • Point elasticity ofdemand • Profitmaximisation
Week 9	Exponents and Logarithms	• Continuous growth and the exponential function • Continuous growth rates and initial amounts • NaturalLogarithms • Derivatives of exponential and logarithmicfunctions
Week 10	Roots	• Roots
Week 11	Binomial Expansions	• BinomialFunctions
Week 12	Linear Algebra Matrices	• Definitions • Operations of matrices (Addition, scalar multiplication, subtraction, multiplication) • Systems of linearequations • Cramers rule,Inverses, • GaussElimination • Gauss-JordanElimination
Week 13		• Minors and Cofactors,determinants • Adjoints ofmatrices • Properties ofdeterminants

Mode of delivery: Lectures, Assignments, Group-work

Instructional materials: Text books, handouts, online notes.

Course assessment: Continuous Assessment Test – 30%, Examination – 70%, Total – 100%

Core reading materials:

1. M. S. Mukras, Elements of Mathematical Economics, Kenya Literature Bureau, 2004.
2. F. S. Budnick, Applied Mathematics for Business, Economics, and the Social Sciences, McGraw-Hill, Inc., 1993.

Recommended reference materials:

1. L. C. Peck, Basic Mathematics for Management and Economics, Scott Foresman and Company, 1970.
2. C. Dinwiddy, Elementary Mathematics for Economists, , Oxford University Press,1967.