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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR FIRST YEAR, SECOND SEMESTER EXAMINATION FOR THE BACHELOR OF ECONOMICS AND FINANCE

Date: 6th December, 2024 Time: 2.30pm –4.30pm

KEC 2200 - ECONOMISTS MATHEMATICS II

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Solve the systems of equations given below using Cramer's Rule (5 marks) 3x₁ - x₂ = 5 x₁ + 2x₂ = 8
b) You are given two investment options: Invest ksh 800,000 at an annual interest rate of 7%, compounded quarterly, for 4 years.

Invest ksh 800,000 at an annual interest rate of 7%, compounded monthly, for 4 years.

i)	Calculate	the fu	iture v	alue for	r eacl	n option.	(6 r	narks)
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- ii) Which option gives a higher return? (2 marks)
- c) Find the Hessian matrix and Hessian determinant of the following functions $Z = 5x_1^2 - 3x_1x_2 - 3x_2 - 7x_2^2 \qquad (4 \text{ marks})$
- d) A commodity market model is defined by the following equations

$$Q = 18 - \frac{2}{3}P$$
$$Q = -6 + \frac{3}{4}P$$

Determine the market equilibrium price and quantity (4 marks)

- e) If you invest ksh 120,000 at 8% annual interest, compounded quarterly, for 2 years. Find the future value with fractional compounding (4 marks)
- f) You invest ksh 650,500 in a savings account that offers a force of interest of 5% for the first 3 years, and then 6% for the next 4 years. What will be the future value of your investment after 7 years? (5 marks)

QUESTION TWO (20 MARKS)

a) The money market of an economy is given by the following equations

$$M_{DT} = \frac{1}{2}Y$$
, $M_{DS} = 100 - 10r$, $M_S = 1500$

	i) Derive the <i>LM</i> function for the economy	(4 marks)
	ii) Find the equilibrium interest rate r when $Y = 3000$	(3 marks)
	iii) Find the equilibrium income Y when $r = 5$	(4 marks)
b)	Find the jacobian matrices and Jacobian determinants of the following equation	tions and check
	whether the two equations are functional independent or independent	(3 marks)
	$y_1 = 5x_1 + 3x_2$	
	$y_2 = 8x_1 + 7x_2$	
c)	Find the slope of $y = 5x^2 + 7x + 12$	(6 marks)

QUESTION THREE (20 MARKS)

c)

a) The commodity and money market for an economy are defined by the following equations Y = C + I

$$C = 200 + \frac{2}{5}Y$$

$$I = 1900 - 12r$$

$$M_{DT} = \frac{1}{2}Y$$

$$M_{DS} = 100 - 10r$$

$$M_{S} = 1500$$

i) Derive the *IS* and *LM* functions for the economy (6 marks)

- ii) What is \overline{Y} and the rate of interest for the economy (6 marks)
- A manufacturing company is considering investing in a new production machine. The b) machine requires an initial investment of Ksh 500,000 and is expected to generate the following cash inflows over the next five years:
 - Year 1: Ksh 120,000
 - Year 2: Ksh 140,000
 - Year 3: Ksh 160,000
 - Year 4: Ksh 180,000
 - Year 5: Ksh 200,000

The company uses a discount rate of 10%.

- i) Calculate the Net Present Value for the project (NPV) (6 marks)
- ii) Determine whether the project should be accepted based on the NPV results (2 marks)

QUESTION FOUR (20 MARKS)

a) Given the following structure of an economy

$$\begin{split} Y &= C + I_0 + G_0 + X_0 - Z \\ C &= C_0 + bY^D \\ T &= T_0 + tY \\ Z &= Z_0 + ZY^D \\ where \ b &= 0.9, X_0 = 150, Z = 0.15, t = 0.2, Z_0 = 55, T_0 = 150, C_0 = 125, I_0 = 92.5, \ G_0 = 600 \end{split}$$

Calculate;

i) The equilibrium level of income (5 marks) ii) The effect of 60 billion increase in autonomous exports on national income equilibrium (5 marks) iii) The effect of a 30 billion increase in autonomous imports on national income equilibrium (5 marks) b) Find the equilibrium price and quantity for the following market model $Q_D = 19 - P^2$ $Q_S = -8 + 2P^2$ (5 marks)

QUESTION FIVE (20 MARKS)

Consider the following production function

$$Q_0 = 40k^{\frac{1}{2}l^{\frac{1}{2}}}$$
(6 marks)i)Find MP_l and MP_k (6 marks)ii)What is the marginal rate of technical substitution of capital for labour, set output $Q_0 =$
80 and find the corresponding isoquant i.e. express k as a function of l(5 marks)iii)Find the marginal rate of technical substitution for $l = 1$ (3 marks)

iv) Does the isoquant obey the law of diminishing rate of technical substitution (6 marks)