CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF MASTERS IN AGRICULTURAL ECONOMICS

AGEC 854: MATHEMATICS FOR ECONOMICSTS

STREAMS: MSC (AGEC) **TIME: 3 HOURS**

DAY/DATE: TUESDAY 14/04/2020 **11.30 AM – 2.30 PM**

INSTRUCTIONS:

- **Do not write on the question paper**
- **Answer question One and any other Three questions**
- **Show your working clearly and use diagrams and charts as necessary**

Question One

(i) Solve the following LP problem using simplex method
Maximize $P = x + 2y + 3z$ subject to the constraint

$7x + z \leq 6$
$x + 2y \leq 20$
$3y + 4z \leq 30$

Where x, y and z are non-negative [9 marks]

(ii) Determine the following partial derivatives

(a) Given $f = (x, y) = 3^x + 3xy^2$, find $f_y(x, y)$ and $f_{xx}(x, y)$

(b) Given $f(x, y, z) = x^2 ye^{3z}$, evaluate $f_{xy}(1,1,0)$ and $f_{yzx}(1,1,0)$

(c) If $ze^z = xy + y^x$, determine $\frac{\partial z}{\partial x}$ and $\frac{\partial y}{\partial x}$ [6 marks]

(iii) Evaluate the following integral

(a) $\int_0^1 (2^t + t^2)\, dt$

(b) $\int_0^4 \frac{In(2x+1)}{\sqrt{2x+1}} dx$

(c) $\int (In\ y)^2 dy$

(iv) In a certain country there are two daily newspapers: The Citizen and the Mirror. A researcher interested in the reading habit of this country found the following: of the readers who read Citizen on a given day 50% do so following day while the rest change to the Mirror. Of those who read Mirror on a given day 40% change to the Citizen the following day. Yesterday the readership levels were 30% citizen and 70% Mirror. Assume all conditions hold.

Required:

(a) Determine the readership levels of both dailies for today and tomorrow.

(b) If this process persists long enough, what will be the eventual readership?

[4 marks]

Question Two

Use Cramer's rule to solve the national – income model. [15 marks]

$C = a + b(Y - T)$ (1)
$T = -t_0 + t_1 Y$ (2)
$Y = C + I_0 + G$ (3)

Question Three

A society has three basic needs; food, shelter and clothing. There are thus three industries in the society _ the farming, housing and garment industries that produce these commodities. Each of these industries consumes a certain proportion of the total output of each commodity according to the following table.

		OUTPUT		
		Farming	Housing	Garment
	Farming	0.4	0.2	0.3
Consumption	Housing	0.2	0.6	0.4
	Garment	0.4	0.2	0.3

Find the annual prices that each industry must charge for its income to equal its expenditure.

[15 marks]

Question Four

Consider the following constrained maximization problem:

Maximize $\text{In}(\text{X}_1 + 1) + \text{In}(\text{X}_2 + 1)$
Subject to

$p_1 x_1 + p_2 x_2 \leq m$

$x_1 \geq 0, x_2 \geq m$

Where $p_1 > 0, p_2 > 0$ and $m > 0$

Where the Kuhn-Tucker first-order conditions for solving the optimization problem.

[15 marks]

Question Five

A man always eats lunch at one of two restaurants, A and B. He never eats at A twice in a row. However, if he eats at B, he is three times as likely to eat at B next time as at A. Initially, he is equally likely to eat at either restaurant.

(a) What is the probability that he eat at A on the third day after the initial one?

(b) What proportion of his lunches does he eat at A? [15 marks]
