CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY IN AGRICULTRUAL EXTENSION AND EDUCATION

SOIL 936: SOIL FERTILITY AND PLANT NUTRITION

STREAMS: PHD (AGED) YISI **TIME: 3 HOURS**

DAY/DATE: WEDNESDAY 22/04/2020 **8.30 AM – 11.30 AM**

INSTRUCTIONS:

ANSWER ALL QUESTIONS IN SECTION A (30 MARKS) AND ANY TWO IN SECTION B (30 MARKS)

SECTION A (30 MARKS: ANSWER ALL QUESTIONS

QUESTION ONE

(a) (i) Explain the format of a soil test report

(ii) Calculate fertilizer dose (kg ha^{-1}) for teff as per six tiers system of fertility rating from the following
Soil available N = 70
Soil available P = 14
Soil available K = 150
Classification chart for soil test data:

Category	Org. C (%)	Av.N (Kg/ha	Av.P (kg/ha)	Av.K (kg/ha)
Very low	<0.20	<140	<7	<100
Low	0.21 – 0.40	141 – 280	8 – 14	101 – 150
Moderate	0.41 – 0.60	281 – 420	15 – 21	151 – 200
Moderately High	0.61 – 0.80	421 – 560	22 – 28	201 – 250
High	0.81 – 1.00	561 – 700	29 – 35	250 – 300
Very high	Above 1.00	>700	>35	>300

(b) Explain the concepts for establishing and maintaining the fertility status of a soil and their challenges. [4 marks]

(c) Explain the soil and plan diagnosis approaches and their diagnostic factors. [6 marks]

QUESTION TWO

(a) The release of elements from the solid phase into the soil solution is the result of an everchanging complexity of the dynamic chemical and biological activities occurring in the soil. Explain the factors that determine the rate at which this process occurs and how these ions are brought into proximity to plant root. [6 marks]

(b) With respect to manganese, explain its content and distribution in plants, movement in soil and root absorption, deficiency and excess (toxicity) symptoms. [5 marks]

(c) Explain the objectives of plant tissue analysis and illustrate how it is carved out. [4 marks]

SECTION B (40 MARKS)

QUESTION THREE

(a) Explain how plants carry out photosynthesis and distinguish between C_3 and C_4 plant species. [6 marks]

(b) The determination of the water pH of a mineral soil, organic soil, or organic soilless medium is done in a ratio-slurry with water, the ratio being specified based on the pH interpretation scale to be used. Normally for mineral and organic soils, the water to soil volume ratio is 1:1, while in an organic soilless mix, water is added to just the saturation point. The time between adding the water to form the slurry and making a reading is determined by the time needed to establish equilibrium, usually between 10 and 30minutes. What factors affect the pH determined in these water slurries and what are the optimum water pH ranges for most plants growing in the different rooting media. [4 marks]

(c) Explain the objectives of basic fertilizer placement and the factors that determine the absorption of a foliar-applied essential plant nutrient element. [5 marks]

QUESTION FOUR

(a) With respect to potassium, explain its functions in plants, available forms for root absorption, deficiency and excess (toxicity) symptoms. [4 marks]

(b) Discuss the origin best management practices concept of BMPs and the focus on management. [4 marks]

(c) Explain the principal objectives for the utilization of a plant analysis result and combining the ratio of soil test Ca to Mg with the lime requirement, that form of limestone would be designated. [7 marks]
