

SCHOOL OF AGRICULTURAL SCIENCES

SECOND SEMESTER 2003/2004

1. AGA 222	:	PHYSIOLOGY OF FARM ANIMALS
2. AGA 322	:	RUMINANT PRODUCTION
3. AGA 332	:	APPLIED ANIMAL NUTRITION
4. AGA 412	:	PIG AND POULTRY PRODUCTION
5. AGA 542	:	ANIMAL HEALTH
6. AGA 552	:	ANIMAL PRODUCTS AND BY-PRODUCTS
7. AGA 562	:	APPLIED ANIMAL BREEDING
8. AGC 342	:	FUNDAMENTALS OF CROP SCIENCE
9. AGC 542	:	ECONOMIC ENTOMOLOGY
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11. AGC 572	:	POAT HARVEST TECHNOLOGY
12. AGE 222	:	FUNDAMENTALS OF MACRO- ECONOMICS
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27. AGF 512	:	TEACHNOLOGY ANF MEAT AND FISH
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29. AGF 532	:	TECHNOLOGY OF PLANT PRODUCTS
30. AGF 542	:	PLANT DESIGN
31. AGS 222	:	FUNDAMENTALS OF SOIL SCIENCE
32. AGS 322	:	SOIL PHYSICS
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35. AGS 452	:	PRINCIPLES OF LAND HUSBANDRY
36. AGS 522	:	SOIL AND PLANT AALYSIS
37. AGS 542	:	SOIL CLASSIFICATION
38. AGS 563	:	MANAGEMENT OF IRRIGATION AND DRAINING SYSTEMS

SHORT LOAN COLLECTION

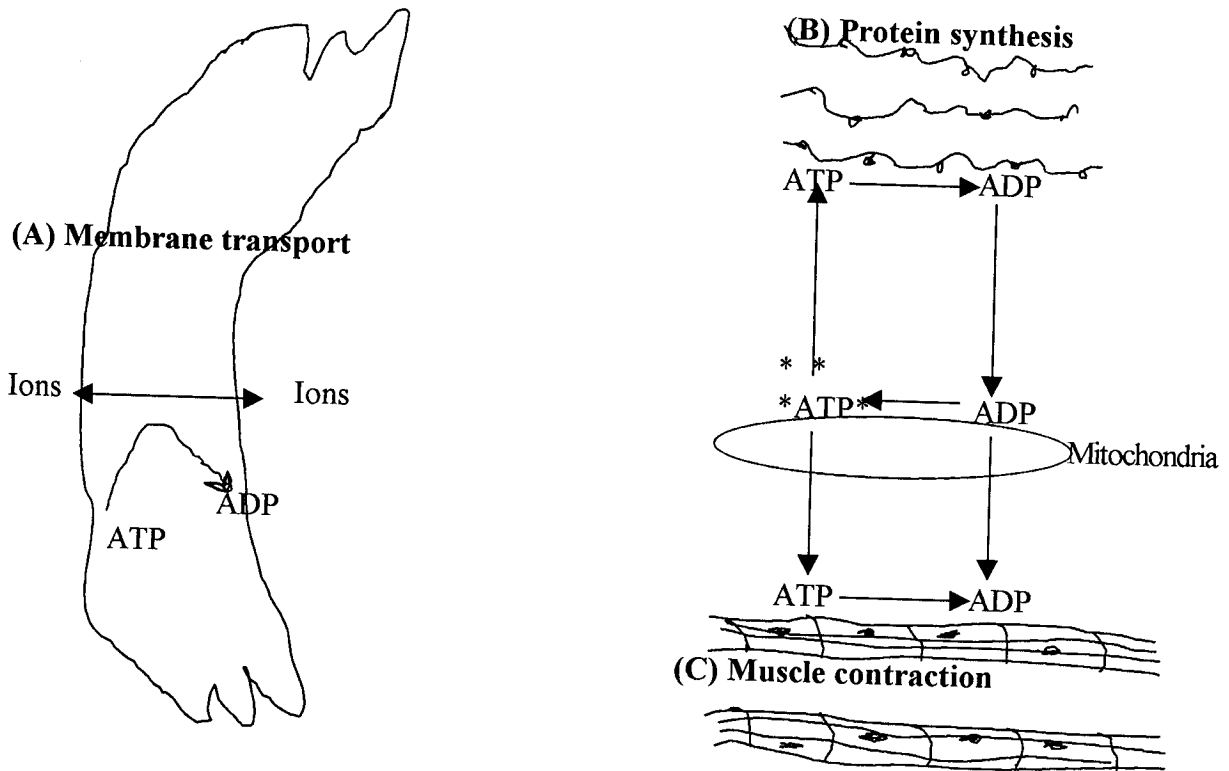
THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2003/2004 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGA 222: PHYSIOLOGY OF FARM ANIMALS

TIME: THREE HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

- Q1.** The following diagram shows three (3) major categories of cellular functions that ATP is used to promote.



- (a) With respect to (A), describe in detail the physiological mechanism, giving any specific example(s). **[10 points]**
- (b) With respect to (B), describe the physiological mechanism, assuming Testosterone and Triiodothyronine are the trigger factors. **[10 points]**
- (c) With respect to (C), describe the mechanism in a cardiac muscle cell of a bull. **[10 points]**

- Q2.** You are face to face with a fierce Friesian bull at a dairy farm where you have gone to visit. He sends you flying over the wire fence, running away at your fastest speed for some 100 m.
- (a) In yourself, what are the likely changes (and why) in the following parameters? **[6 points]**
- Oxygen consumption
 - Blood flow to the calf muscle
 - Diameter of blood vessels
 - Adrenaline and Noradrenaline concentrations.
- (b) In yourself, describe the physiological mechanism that leads to the breakdown of glycogen and the consequence of this glycogenolysis. **[7 points]**
- (c) Assuming the bull is slaughtered shortly after this brief “heavy exercise”, what is the likely outcome of the meat with respect to quality? Explain. **[7 points]**
- Q3.** A veterinary surgeon has just performed parathyroidectomy on a sow. Describe the consequences of such an operation. **[10 points]**
- Q4.** A strong acid has a very strong tendency to dissociate into ions thereby discharging its H^+ ions into the solution, while a weak acid has less vigour to release H^+ ions. A strong base powerfully reacts with H^+ ions and removes them from the solution, while a weak base binds much more weakly with H^+ ions. The animal body contains various types of fluids with varying acidity.
- (a) Calculate the pH of 0.04 M HCl solution in the gastric juice. **[2 points]**
- (b) Calculate the $[H^+]$ in bile whose pH is 5.8. **[2 points]**
- (c) How many moles of sodium acetate and how many moles of acetic acid are needed to prepare 2 litres of 0.2 M solution having a pH 5.0? (pK_a for acetic acid = 4.6). **[2 points]**
- (d) What are the three major buffer systems of the body fluids? **[3 points]**
- (e) Assume the pH of a body fluid is 7.43 and the pK_a of a buffer system is 6.0, comment on the buffering capacity of this buffer, giving an explanation. **[6 points]**
- Q5.** A Large group of sows was bred by artificial inseminations in a reproductive study. All sows were judged to be “in heat” at the time of insemination on the basis of behavioural activities. Blood samples were collected at the time of insemination and twelve hours later. Plasma concentrations of hormones and data on conception rates were determined. It was found that the sows could be placed in one of three groups depending on their plasma

hormone profiles. The profiles and % conception rates for each of the groups A, B and C are shown in Table 1. Discuss the results and suggest reasons to explain the different conception rates in groups A, B, and C despite the fact that all sows were in heat at insemination. [25 points]

Table 1

Parameter	G R O U P					
	A		B		C	
	I	I+12	I	I+12	I	I+12
Estrogen	175	195	230	190	180	100
Progesterone	0.9	0.5	0.5	0.5	0.5	2.2
LH	0.2	0.6	4.9	1.6	0.6	0.2
Conception rate, %	25		95		35	

I = time of insemination
I+12 = twelve hours later

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END OF EXAMINATIONS

THANK YOU FOR BEING WITH ME IN THE COURSE. WISHING YOU A HAPPY NEW YEAR!

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2003 ACADEMIC YEAR - SECOND SEMESTER FINAL EXAMINATIONS

COURSE AGA 322 - RUMINANT PRODUCTION

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

- a) All questions carry equal marks.
 - b) Answer any five (5) questions.
-

SECTION A - BEEF PRODUCTION:

- Q. 1** As a graduate of the University of Zambia, you have been requested to make a presentation to a farmer group consisting of retirees from the Government Service who have just heard that the fertiliser 'Urea' can be used during the dry season as cattle feed. Prepare detailed notes for your presentation on the reasons and how urea should be used as cattle feed.
- Q. 2** Write notes on the following:
- a) The advantages and disadvantages of using the Summer Breeding Season by beef producers in Zambia; and
 - b) The causes of cyclic and compensatory growth in beef cattle in Zambia . and methods that are adopted by farmers to overcome them.

SECTION B - DAIRY PRODUCTION:

- Q. 3** Milk has been described as 'nature's most perfect food' and the cow as 'the foster mother of the human race' because of the universal acceptance of cow's milk. Write notes on any five (5) physiological factors that may affect the composition of milk on any dairy farm of your choice.
- Q. 4** Write notes on the following:
- a) Lactogenesis;
 - b) The causes of poor fertility in dairy cows in Zambia;
 - c) The factors affecting the milk ejection process; and
 - d) The farmer/dairyman as the potential source of milk contaminants.

SECTION C - SHEEP AND GOAT PRODUCTION:

- Q. 5** As a graduate from the University of Zambia, you have been offered employment as a Farm manager on a Sheep and Goat farm. Discuss any ten (10) the lamb and kid routine management practices that you would put in place in order to improve the management of a sheep and goat on a farm of your choice.
- Q. 6** Write notes on the following:
- a) The factors that may affect the dry matter intake (DMI) of sheep and goats in Zambia; and
 - b) The factors that may be taken into consideration when selecting breeding ewes and nannies.

SECTION D - RABBIT PRODUCTION:

- Q. 7** Discuss the advantages of rabbit production over other forms of livestock production in Zambia.
- Q. 8** Write notes on the following:
- a) The factors that affect the feed intake of rabbits in Zambia; and
 - b) The factors that may limit the conception rate in breeding does on a rabbit farm of your choice.

**UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
SECOND SEMESTER EXAMINATIONS
JANUARY 2004**

AGA 332 – APPLIED ANIMAL NUTRITION

INSTRUCTIONS

TIME: THREE (3) HOURS

ATTEMPT: ALL THE FIVE (5) QUESTIONS

1. Well preserved silage makes good roughage for ruminant feeding. Discuss how poor preservation can result in loss of feeding value in a silage.
(10 marks)
2. Discuss the known negative attributes of cotton seed meal as an ingredient in livestock feeds.
(10 marks)
3. Explain why sorghum may not be a first choice grain for use in broiler diets.
(10 marks)
4. Prepare a formula for a vitamin premix, containing 8g of an anti-oxidant as a preservative, which should be used at a rate of 0.1% in a 200kg pig feed using information given below.

<u>Vitamin</u>	<u>Requirement per kilogram feed</u>	<u>Concentration in source</u>
A	1,500IU	500,000IU/g
D	400IU	400,000IU/g
E	20IU	50,000IU/kg
K	5mg	65%
Niacin	60mg	85%
Folic acid	2mg	100%
Biotin	0.5mg	20,000mg/kg

(15 marks)

P.T.O

5. For broiler requirements of 3200kcal/kg ME, 24% crude protein, 1.2% lysine, 0.5% methionine, 1% calcium and 0.75% phosphorus, formulate a ration using information given below.

<u>Ingredient</u>	<u>ME(kcal/kg)</u>	<u>CP%</u>	<u>Lysine%</u>	<u>Methionine%</u>	<u>Calcium%</u>	<u>Phosphorus%</u>
Maize meal	3330	8.6	0.24	0.20	0.20	0.28
Full-fat soya*	3880	37.5	2.40	0.50	0.15	0.50
Soybean meal	2490	45.0	3.00	0.65	0.25	0.60
Tallow	7000	-	-	-	-	-
Limestone	-	-	-	-	38	-
DCP	-	-	-	-	22	18
Methionine	-	-	-	98	-	-
Lysine	-	-	89	-	-	-
Salt	-	-	-	-	-	-
Vitamin premix**	-	-	-	-	-	-
Mineral premix**	-	-	-	-	-	-

* Full-fat soybean meal is to be used at the rate of 12% of the ration.

**The inclusion rates for premixes is 1% (for each).

(15 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2003 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

COURSE AGA 412: PIG AND POULTRY PRODUCTION

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer the two sections (Section A and Section B) in separate booklets
 2. Answer all questions.
 3. All questions carry equal marks.
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Section A

1. What factors should be considered in selecting a location for a pig farm? Briefly discuss the factors.
2. Describe how one would evaluate the reproductive potential of a boar.
3. Discuss the feeding of a sow and litter of 11 (eleven) piglets from farrowing to weaning assuming the sow has entered lactation in good condition.

Section B

1. A farmer comes to you with the complaint that her 3-week old chicks are weighing less than expected for their age. Upon visiting the poultry unit you are met with a strong pungent smell at the door. You observe that the birds spend most of the time sitting huddled together,

mostly close to heaters. You also notice that the litter is wet and some of the faeces on the litter are blood stained. In the forty-five minutes that you spend in the poultry house, only a few birds stand up to eat.

- i. What is your explanation for the slow growth of the chicks?
 - ii. What advice would you give the farmer concerning your observations in the brooder?
 - iii. What other factors can cause a reduction in the growth rate of chicks?
2. Give an outline of broiler chicken management from day old to the time the birds attain market weight.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCE
2002/2003 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATION

AGA 542: ANIMAL HEALTH
TIME: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES

Answer questions from sections A and B

Section A

Instructions: Answer any two (2) questions from this section

Q1. Using a sketch map of Zambia provided, indicate the distribution of the following diseases of livestock:

(10 marks)

- Corridor disease
- Contagious bovine pleural pneumonia
- Bovine tuberculosis
- Haemorrhagic septicaemia
- Foot-and –mouth disease
- East cost fever
- Anthrax
- Brucellosis
- African swine fever
- Rabies

Remember to attach the map of Zambia to your answer sheet.

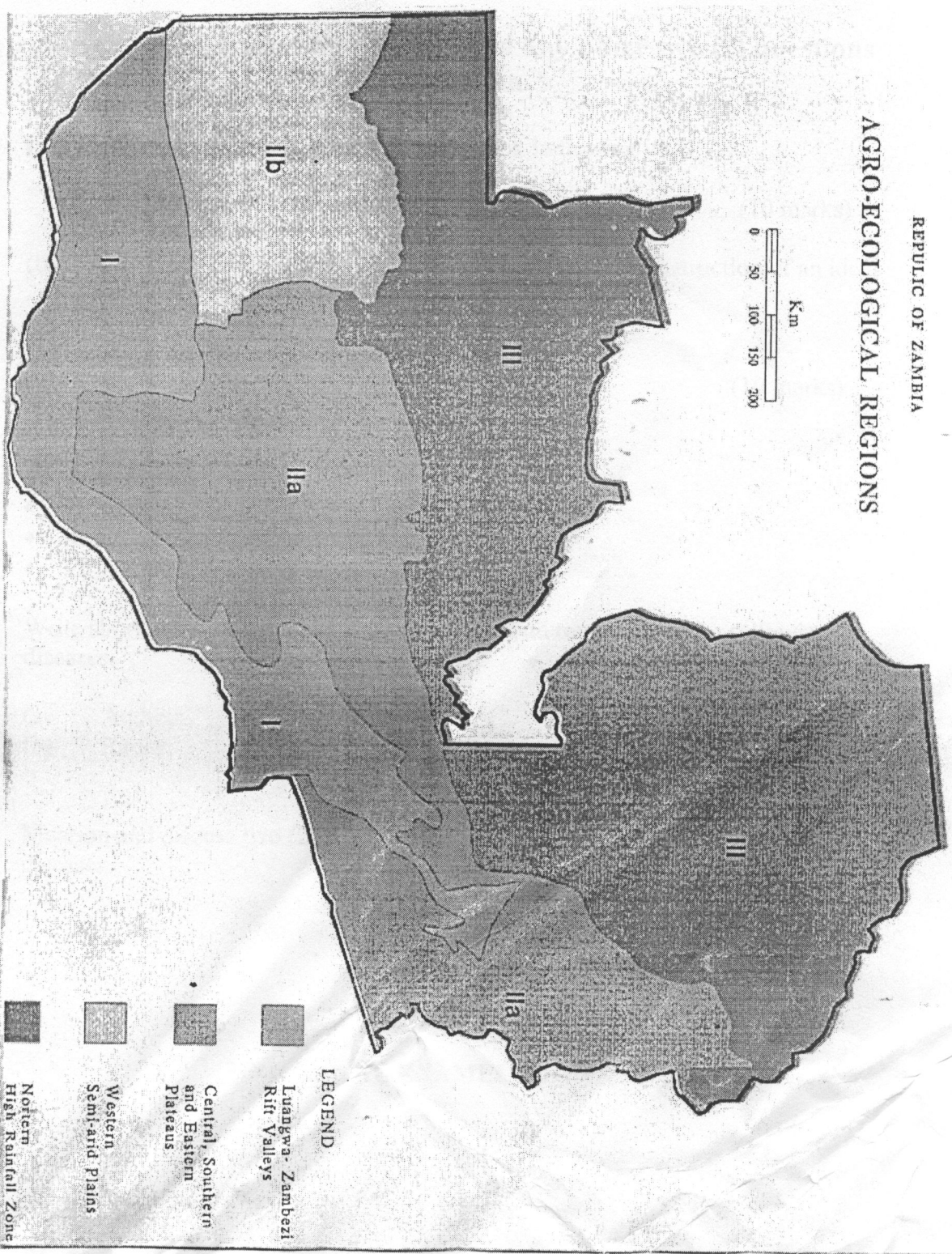
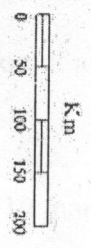
Q2. Discuss in detail methods of diagnosing diseases in livestock.

--(10 marks)

Q3. Discuss in detail the negative impact of livestock diseases in the communal areas of Southern province of Zambia.

(10 marks)

AGRO-ECOLOGICAL REGIONS



LEGEND

- Luangwa-Zambezi Rift Valleys
- Central, Southern and Eastern Plateaus
- Western Semi-arid Plains
- Northern High Rainfall Zone

Section B

Instructions Answer question one (1) and any other two (2) questions from this section.

- Q4. (a) Draw a sketch of an ideal cattle dip tank indicating its parameters. (10 marks)
- (b) Mention and discuss all the factors required in the construction of an ideal cattle dip tank (10 marks)
- Q5. Define the following terminologies: (10 marks)
- Charging
 - Replenishing
 - Stripping
 - Reinforcement
 - Efficiency
- Q6. Write short notes on the clinical signs, control and treatment of the following diseases: (10 marks)
- (a) Anthrax
- (b) Rabies
- Q7. Mention and discuss two (2) fundamental decisions in the control of livestock diseases. (10 marks)

END OF THE EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES 2003/2004 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATIONS

AGA 552: ANIMAL PRODUCTS AND BY-PRODUCTS

TIME: THREE HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

QUESTION 1. (30 points)

Although more than 80% of cattle in Zambia are produced by small scale farmers, only about 20% of the hides reaching the tanneries may be graded I or II. The rest are graded very lowly.

- (a) What advice would you give to the small-scale livestock producers to get the full benefit of hides?
- (b) What advice would you provide to the slaughter houses?
- (c) Write short notes on the following:
 - (i) Wet-salting
 - (ii) Dry-salting
 - (iii) Brine cure
 - (iv) Tanning

QUESTION 2 (30 points)

- a) Explain what the terms "Normal", "DFD" and "PSE" mean with respect to meat quality.
- b) As the pH drops to its normal value of 5.4 to 5.7, it approaches the isoelectric point of the major myofibrillar proteins. Describe what happens to the water holding capacity during this process.
- c) Describe the physiological role of the catecholamines in DFD and PSE meat.

- d) Glucidic Potential (GP) is defined as the sum of glycogen and its major metabolites from anaerobic glycolysis (glucose, glucose-6-phosphate, and lactate). What are the implications of high and low GP in relation to the ultimate pH?
- e) A pig farmer from Chisamba needs some expert advice. Out of the 200 pigs he has delivered to ZAPP for slaughter, 39% have yielded PSE meat. Please provide the advice.

QUESTION 3 (20 points)

You are a beef producer, mainly raising Hereford steers on concentrate feed. Upon slaughter of the first batch of your animals at Kembe Meat Products, about 40% of the carcasses receive a low grade because they are too fat. What factors are you going to consider in the subsequent batches so that your animals are not downgraded? (Suggest as many alternatives as possible).

QUESTION 4 (20 points)

Meat structure, firmness and texture are important meat properties that are usually evaluated by consumers with their visual, tactile and gustatory senses. Discuss the factors that influence these properties.

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END OF EXAMINATION

Thank you for being with me in the course. Wishing you a happy New Year!

THE UNIVERSITY OF ZAMBIA
2002/2003 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS

AGA 562 – APPLIED ANIMAL BREEDING

TIME: 3 HOURS

INSTRUCTIONS: ANSWER ANY FIVE (5) QUESTIONS

1. a. The average adjusted weaning weight (AWW) in a cattle herd is 150kg and $s = 15\text{kg}$. It is assumed that many loci are involved with the genetic variation of this trait. The effects of two loci are:

$$AA = Aa = 3; \quad BB = Bb = 5$$

$$aa = bb = -2$$

$$A_ + B_ = +1$$

$$A_bb \text{ or } aaB_ = -4$$

Indicate the phenotypic effects of the following genotypes:

- (i) AaBb (ii) AAbb (iii) aaBB (iv) aaBb (v) aabb

- b. In a herd of 2,000 Angus cattle, five (5) are red. Estimate P, the gene frequency of the gene for black in the herd.

Assumptions:

Let $f_B = \text{black} = P$; $f_b = \text{red} = q$; the survival rates of individuals of all genotypes are equal and there is no mutation.

2. In data analysis: $n = 40$; $\bar{x} = 12$;

$$(\sum X)^2 = 57,600; \quad \sum(X^2) = 3,184; \quad \sum xy = 213; \quad (\sum x^2); \quad (\sum y^2) = 70,756$$

$$\sqrt{70,756} = 266; \quad y^2 = 233$$

- a. Calculate $\sum x^2$ for these data
- b. Calculate s (estimate of σ) for these data
- c. Calculate r (correlation coefficient)
- d. Calculate b (regression coefficient)

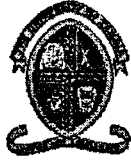
3. Mr. Mulimi, a farmer in Chongwe, heard of the demand for goats by Middle-East Arab countries some two years ago. He decided not to pass on the opportunity, so he bought Bill (B) a buck and Angie (A), a doe. The two goats had twins, Dan (D) a he-goat and Eve (E) a female goat. Dan mated with Cathy (C), a neighbor's female goat. From that relationship was born Patrick (P), a male goat. Eve mated with Gary (G), another neighbor's buck and produced Queen (Q) a beauty queen by goat standards. Patrick and Queen mated and produced Xavier (X).
 - a. Sketch the pedigree for Mr. Mulimi's goats.
 - b. Calculate F_x
 - c. Calculate R_{PQ}
 - d. Later on, Dan and Eve mated and produced Steve (S). What is the relationship between the inbreeding coefficient of Steve (F_s) and the coefficient of relationship between Dan and Eve?
4.
 - a. Explain three genetic causes (refer to gene action) for heterosis or 'hybrid vigor'.
 - b. Daily milk yield records of close relatives of a bull used to sire F_1 's: 25.1, 19.8, 22.3, 23.2, 19.6 kg

Daily milk yield records for F_1 's: 23.5, 33.8, 27.4, 31.9, 24.9 kg

Daily milk yield records for cows: 17.9, 14.4, 16.7, 24.7, 20.3, 17.6 kg

Calculate heterosis.
5.
 - a. An important tool used in the improvement of farm animals is selection. What are the factors that selection depends on for effectiveness?
 - b. Discuss concisely three (3) methods used when selecting to improve several traits.
6.
 - a. Briefly describe the Rotational cross breeding system, outlining its advantages and disadvantages.
 - b. Should a commercial calf producer practice inbreeding? Give reasons for your answer.

END OF EXAMINATION



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCE**

SECOND SEMESTER FINAL EXAM JAN, 2003

AGC 312 CROP PROTECTION

TIME: - 3 HOURS

ANSWER QUESTIONS FROM EACH SECTION ON A SEPARATE ANSWER SHEET. SECTION ONE

ANSWER ALL QUESTION FROM SECTION ONE, ANSWER ONE QUESTION FROM SECTION TWO, ANSWER QUESTION 1 AND ONE OTHER QUESTION FROM SECTION THREE.

READ INSTRUCTIONS FOR EACH SECTION CAREFULLY

SECTION ONE:- PLANT PATHOLOGY

ANSWER ALL QUESTIONS

Q1 a) Explain the following ^{• giving} two examples of each.

- | | |
|-------------------------|-----------------------------|
| 1. Damping off | 2. Damping-off |
| 3. Blight | 4. Anthracnose |
| 5. Galls | 6. Sign and symptom |
| 7. Canker | 8. Leaf spots |
| 9. Post harvest disease | 10. Downy mildew (10 marks) |

**b) List biotic and abiotic disease causing agents giving two examples of each.
Discuss one pathogen that is different from other pathogens.
(20 marks)**

Q2 a) What is plant pathology? How would you distinguish a diseased plant from a healthy one? (~~10~~ marks) 5 marks

b) Why is plant pathology important? (~~10~~ marks) 5 marks

SECTION TWO:- PLANT ENTOMOLOGY
ANSWER QUESTION 1

Q1 The sole reliance on insecticides for the control of insects has led to many Problems. Discuss (30 marks)

SECTION THREE:- WEED SCIENCE

ANSWER Q1 AS IT IS COMPULSORY AND ONE OTHER QUESTION. MARKS FOR EACH QUESTION ARE INDICATED

Q1 20 marks COMPULSORY

a) Fill in the following table

	Weed (Scientific name)	Family
1		
2		
3		
4		
5		
6		
7		
8-		
9		
10		

Weeds should cover at least five families

- b) Discuss, in three to four paragraphs, why weeds are the most underestimated pest in tropical agriculture.
- c) Define a weed from a weed scientist’s viewpoint.

Q2. (10 marks)

- a) Discuss the individual characteristics of weeds.
- b) Enumerate the components of cultural weed control

Q3. (10 marks)

- a) Compare and contrast weed eradication, weed control and weed management.
- b) List five beneficial effects of weeds.

- END OF EXAM -



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCE

FINAL SEMESTER EXAMINATIONS
2002/2003 SECOND SEMESTER FINAL EXAMINATION

AGC342: FUNDAMENTALS OF CROP SCIENCE

TIME ALLOWED: Three Hours

INSTRUCTIONS:

- (i) answer questions as indicated in sections
- (ii) marks for each question as indicated

SECTION A: ANSWER ALL QUESTIONS

Question 1 (15 marks)

- (a) What is:
 - (i) Photoperiodism?
 - (ii) Nutrient depletion?
 - (iii) Respiratory ~~coefficient?~~ *quotient?*
- (b) Give a brief description of C3, C4 and Crassulacean acid metabolism plants
- (c) Why is temperature important in plant growth?
- (d) What are the functions of water in a plant?
- (e) Name three constraints faced by farmers in each of the social, environmental, and economic areas. Indicate how these constraints can be overcome.

Question 2. (25 marks)

- (a) How does the knowledge of the dynamic balance of water assist to control the quantity and availability of soil water?
- (b) The initial soil water content θ_1 under a crop with roots distributed within the profile to a depth of 50 cm is given in Table 1. Calculate the net irrigation depth if the soil is to be irrigated to field capacity, θ_{FC} .

Table 1

Soil Layer	Depth (cm)	θ_{FC}	θ_1
1	0-20	0.30	0.18
2	20-50	0.28	0.19

SECTION B: ANSWER ANY THREE QUESTIONS

Question 3 (20 marks)

- (a) Why is reference evapotranspiration important?
- (b) What method (s) best estimates reference evapotranspiration?
- (c) How does reference evapotranspiration relate to plant growth parameters?

Question 4. (20 marks)

- a) What are essential and beneficial elements?
- b) Describe two functions for each of the following nutrients in plants:
 - (i) Nitrogen
 - (ii) Phosphorus
 - (iii) Calcium
 - (iv) Zinc
 - (v) Boron
 - c) List the forms in which the above nutrients are taken up by plants. Which of these elements' uptake is greatly influenced by soil pH?

Question 5. (20 marks)

- a) Describe mass flow, diffusion and root interception. Under what conditions are these processes important?
- b) Describe
 - (i) Nutrient buffer capacity
 - (ii) Plant nutrient depletion
- c) What law describes the diffusion of plant nutrients to plants? Describe the terms of the equation.

Question 6. (20 marks)

- a) What is Agroforestry?
- b) Briefly describe:
 - (i) The benefits of growing crops in a mixed cropping system.
 - (ii) At least two conservation tillage methods practiced in Zambia.
- c) Improved fallows are increasingly being promoted as a strategy for soil improvement to increased crop production. List the benefits of this technology. Which tree species are the candidate technologies?

Question 7. (20 Marks)

- (a) The families Leguminosae, Cruciferae, Malvaceae and Rubiaceae constitute important crops in the economy of the country. List two members of each family and give their scientific names.
- (b) Describe their economic importance.

END OF EXAM



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

DEPARTMENT OF CROP SCIENCE

**JANUARY 2004 2ND SEMESTER FINAL EXAMINATIONS
AGC 422 – HORTICULTURAL SCIENCE 1**

TIME ALLOWED: 3 Hours

INSTRUCTIONS: Answer all Questions

1. A retiree would like to use compost on the farm for the first time. What advise would you give such a farmer concerning the preparation of compost? **(15 marks)**
2. You have been approached by a farmer who has observed the following in his/her fields:-
 - a. Silvery sheen on leaves
 - b. Dull grey tubers
 - c. Swellings on Roots
 - d. Web on the underside of leaves.

In each case, give the name of the disease/pest, crop(s) attacked, other symptoms and control measures to be undertaken. **(30 marks)**

3. You have been contracted to grow and supply a farmer with the following seedlings:-
 - a. Mint
 - b. Grapes
 - c. Rubber
 - d. Peach.

How would you proceed to raise these seedlings? Outline the methods to be used. **(20 marks)**

4. Discuss limitations a horticultural farmer would face in the production of crops. **(15 marks)**
5. In growing a tomato crop, give recommendations on the following:-
 - a. Seed rate
 - b. Spacing
 - c. Fertilizers
 - d. Pruning and staking
 - e. Irrigation and weed control. **(20 marks)**

END OF EXAM

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF CROP SCIENCES

SECOND SEMESTER FINAL EXAMINATION

COURSE: AGC 552 HORTICULTURAL SCIENCE

INSTRUCTIONS

1. Answer any four
 2. Time: Three (3) hours
-

1. What are the potential impacts of horticultural industry on the environment . ?
 2. As a Horticultural extension worker what advice would you give to a prospective grower intending to establish a mango orchard?
 3. Give an overview of the status of the fruit industry in Zambia outlining the key exotic and or indigenous fruits, main production areas, potentials and limitations.
 4. What are the reasons for pruning and training and briefly suggest the pruning and training methods you would use in either mango, or passion fruits.
 5. Write short notes on any two: -
 - a. Carbohydrate partitioning
 - b. Use of gibberelic acid in horticulture
 - c. Juvenility
-

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

AGE 222: FUNDAMENTALS OF MACRO-ECONOMICS

TIME: THREE HOURS (3)
ANSWER: AS PER INSTRUCTIONS BELOW
MARKS: 100

SECTION A

MULTIPLE CHOICE QUESTIONS

INSTRUCTIONS: ANSWER ALL QUESTIONS FROM THIS SECTION (10 MARKS)

1. Which of the following prevents the use of GNP as an accurate measure of well being in an economy?
 - a) the income distribution in the economy
 - b) the population of the economy
 - c) expenditure on police or fire protection
 - d) non-marketed commodities
 - e) all of the above

2. Suppose 50 lamps and 10 TV's are produced in 1970 at prices of K10 and K 5 and suppose 40 lamps and 5 TV's are produced in 1960 at the same prices:
 - a) Since there is no change in any of the prices, there will be no change in any of the price indexes.
 - b) The consumer price index will increase because the quantities of lamps and TVs increased.
 - c) The GNP implicit price deflator will increase because the quantities of lamps and TV's increased.
 - d) Even though no prices have increased, the consumer price index will show an increase because it always overstates the average price increase.

3. If an economy experiences an 8% growth rate in nominal GNP, then.
 - a) Real GNP must be growing at a rate less than 8%
 - b) The potential growth rate must be less than the actual growth rate.
 - c) The consumers in the economy must experience increased welfare.
 - d) All the above
 - e) None of the above.

4. A decrease in the marginal propensity to save:
- a) Increases the multiplier
 - b) Decreases the multiplier
 - c) Has no effect on the multiplier
 - d) Increases autonomous consumption
 - e) Decreases autonomous consumption
5. If the $MPC = 0.75$ and a contractionary gap of K100 exists,
- a) The government should decrease net taxes by K100.
 - b) The government should increase the size of its budget , by increasing taxes and spending by K100.
 - c) The government should decrease government spending by K100
 - d) The government should increase government spending by K100
6. The difference between M1 and M2 is
- a) Demand deposits
 - b) Currency and coins not circulating but in collections
 - c) Time deposits at commercial banks
 - d) Any account earning interest.
7. An increase in the money supply with no shift in the demand for money curve will result in:
- a) No change in the price of bonds
 - b) A decrease in the price of bonds
 - c) An increase in the price of bonds
 - d) An increase in the interest rate
 - e) None of the above
8. A large crowding out effect is associated with:
- a) Highly effective monetary policy
 - b) Planned investment that is sensitive to the interest rate
 - c) A high ratio of planned to unplanned investment
 - d) Weakness of the interest rate transmission mechanisms

9. The theory of inflation that adequately explains inflation during all time periods is:

- a) The crude quantity theory of prices
- b) The Phillips curve
- c) Keynesian theory
- d) Cost-push inflation theories
- e) None of the above

10. Inflationary recession requires

- a) An expectation of price increases in the future
- b) A decline in nominal national income
- c) A fall in real national income
- d) All of the above
- e) Choices a and b.

SECTION B: SHORT ANSWER QUESTIONS
INSTRUCTIONS: ANSWER ALL QUESTIONS FROM THIS SECTION (30 MARKS)

1. Fill in the columns headed APC, MPC, APS and MPS in the following table:

a)

Y	C	APC	MPC	APS	MPS
0	50				
100	130				
200	210				
300	290				
400	370				
500	450				

- b) As income rises what happens to APC and MPC?
- c) If income rises by K10 million, by how much will spending increase?
- d) If income falls by K30 million by how much will consumption spending fall?

2. Suppose that the marginal propensity to consume falls from 0.8 to 0.75. if investment is K20 million, what will be the new equilibrium level of income? If consumption has fallen from K 80 million what is the new level of consumption?

4. A decrease in the marginal propensity to save:

- a) Increases the multiplier
- b) Decreases the multiplier
- c) Has no effect on the multiplier
- d) Increases autonomous consumption
- e) Decreases autonomous consumption

5. If the $MPC = 0.75$ and a contractionary gap of K100 exists,

- a) The government should decrease net taxes by K100.
- b) The government should increase the size of its budget, by increasing taxes and spending by K100.
- c) The government should decrease government spending by K100
- d) The government should increase government spending by K100

6. The difference between M1 and M2 is

- a) Demand deposits
- b) Currency and coins not circulating but in collections
- c) Time deposits at commercial banks
- d) Any account earning interest.

7. An increase in the money supply with no shift in the demand for money curve will result in:

- a) No change in the price of bonds
- b) A decrease in the price of bonds
- c) An increase in the price of bonds
- d) An increase in the interest rate
- e) None of the above

8. A large crowding out effect is associated with:

- a) Highly effective monetary policy
- b) Planned investment that is sensitive to the interest rate
- c) A high ratio of planned to unplanned investment
- d) Weakness of the interest rate transmission mechanisms

2. Given the following economic system:

$$Y = C + I + G + X - M$$

$C = 100 + 0.8Y_d$	Consumption function
$I = 150$	Investment function
$G = 200$	Government expenditure
$S = -100 + 0.2Y_d$	Savings function
$T = 0.25Y$	Tax function
$X = 100$	Exports
$M = 0.1Y$	Imports

Where Y is the level of national income.

- Find the equilibrium level of national income.
- What is the value of the multiplier for this economy?
- Is there a budget surplus or budget deficit at the equilibrium level?
- Is the government pursuing an expansionary or contractionary policy?
- Assuming exports remained at K 100 million but marginal propensity to import were 0.2, what difference would this make to:
 - income
 - net exports

(20 marks)

3. Explain what you understand by the following concepts:

- Liquidity trap
- Terms of trade
- Comparative advantage
- Open market operations

(20 marks)

4. What is the basic determinant of:

- the transactions demanded for money
 - the assets demand for money
- Explain what you understand by
 - double counting
 - Transfer payments

(20 marks)

5. a) What are the major phases of the business cycle?

b) What is the objective of the following actions of the central bank?

- i) Selling bonds in the open market
- ii) Lowering the required reserve ratio

How is each supposed to work?

(20 marks)

END OF EXAM

AGE 442
Agribusiness Statistics and Data Analysis

Instructions: Answer one question from Section A (30 points). Answer question 3 and any one of questions 4 and 5 in Section B (70 points)

Time: Three (3) hours

Section A (30 points)

There are two questions in this section, each worth 30 points. Answer any one of these questions.

1. A forecast, often regarded as the principle purpose of econometrics, is defined as a quantitative estimate or set of estimates about the likelihood of future events based on past and current information.
 - a) In not more than three sentences, what are forecasts used for?
 - b) Very briefly, compare and contrast the following
 - i) Ex post and ex ante forecasts
 - ii) Conditional and unconditional forecasts
 - c) List two criteria for determining if you have the best forecast.
 - d) List three sources of forecast error.
 - e) Autoregressive Integrated Moving Average (ARIMA) models, otherwise called Box-Jenkins models, provide another avenue for forecasting. Answer the following questions on ARIMA models.
 - i) ARIMA models are dependent on economic theory. True or False? Explain.
 - ii) What does the presentation ARIMA(1,0,1) mean?
 - iii) State and briefly explain the three steps for performing time series analysis with ARIMA models.
2. In econometrics, ordinary least squares is regarded as a standard and is recommended when all the five CLRM assumptions hold. One such assumption is that the explanatory variables are fixed in repeated samples.
 - a) State and briefly explain three of the causes of violation of this assumption.
 - b) What are the consequences of applying OLS to a system of simultaneous equations?
 - c) Compare and contrast the following in relation to simultaneous equation models
 - i) Single-equation estimators/methods and systems methods
 - ii) Two-stage least squares (2SLS) and three-stage least squares (3SLS)
 - d) In a sentence or two, what is seemingly unrelated regression?

Section B (70 points)

There are three questions in this section. Answer Question 3 (40 points) and any one of questions 4 and 5 (30 points), bringing the total number of questions that you are expected to answer to two.

3. A 2002/03 fifth year student in the Department of Agricultural Economics and Extension Education, has estimated, for his AGE 500 project, the following econometric equation using 20 year annual data (1980-1999):

$$\hat{Q}_{mz} = 50.736 + 0.0392 P_{maize} - 0.0002 P_{sorg} + 0.0033 P_{mil} + 0.3820 X_{food} - 37.463 D_{lib}$$

(0.003) (0.132) (0.993) (0.768) (0.062) (0.000)

F statistic = 16.351; $R^2 = 0.854$; Adjusted $R^2 = 0.802$;
DW statistic = 1.419

where figures in brackets are *p-values*,

\hat{Q}_{mz} = Predicted value of quantity of maize demanded by Zambian consumers in kg per capita,

P_{maize} = Real price of maize in Kwacha per kg,

P_{sorg} = Real price of sorghum in Kwacha per kg,

P_{mil} = Real price of millet in Kwacha per kg,

X_{food} = Cereal food aid in kg per capita, and

D_{lib} = Liberalization dummy variable, equal to one if in the agricultural market reform period (after 1991) and zero otherwise.

- a) Is the relationship represented by this equation statistically significant at 1% level of significance? Use the attached F Distribution tables to determine the critical value for the F statistic.
- b) What proportion of the variation in \hat{Q}_{mz} is the equation able to explain?
- c) Based on the p-values (in brackets), list the variables whose parameters are statistically different from zero at
- 5% level of significance
 - 1% level of significance
- d) Are all the signs of the parameter estimates in agreement with your a priori expectations based on economic theory? If no, list the variables with wrong signs and explain why you think the signs are wrong.
- e) In the preliminary runs, the student had included real per capita gross domestic product (real GDP) as an explanatory variable but later dropped it because it had an unacceptably high variance inflation factor (VIF).
- Do you think this was a good move? Explain.
 - List the two other strategies for dealing with the problem of high VIF.
 - What problem does a high VIF indicate?
- f) Test for the presence of (positive or negative) autocorrelation. Assume that $d_L = 0.952$ and $d_U = 1.147$.

4. The following regression equation was obtained by ordinary least squares using a sample of size 80:

$$\hat{y} = 2.200 + \underset{(3.4)}{0.104}x_1 + \underset{(0.005)}{3.480}x_2 + \underset{(2.200)}{0.340}x_3,$$

where values in brackets are **standard errors**, SSR (regression sum of squares) = 112.5 and SSE (error sum of squares) = 19.5.

- Which of the slope coefficients are statistically different from zero at the 5% level of significance, given that $t_{(\frac{\alpha}{2}=0.025; df=76)} = 1.980$. Be sure to show your work.
- Calculate the value of R^2 for this regression.
- Test whether the equation is statistically significant at the 1% level of significance. Use the attached F Distribution tables to determine the critical value for the F statistic. Be sure to state the degrees of freedom for this statistic.

5. You have observed through the four years that you have been on campus that students use one of two modes of transport – minibus or taxi – to travel to town. You are interested in determining the probability that a student will use a minibus. To do this, you develop the variable “mode of transport”, y , and code its two categories as one if minibus and zero if taxi. From your knowledge of econometrics, you determine that each observation of y will follow a Bernoulli probability density function, given as

$$f(y_i) = p^{y_i} (1 - p)^{1-y_i},$$

where p is the probability of success (i.e. the probability that the student will use a minibus) and y_i is the value of y in observation i .

- Derive the maximum likelihood estimator (MLE) for p , assuming a sample of size n .
- Suppose you interview 5 students and obtain the following results:

Observation i	1	2	3	4	5
y_i	0	1	1	0	1

Use MLE to estimate the probability of using a minibus based on these data.

- In a regression model with mode of transport, y , as the dependent variable, MLE is one of the preferred estimators for determining the regression parameters. Briefly explain why OLS is inappropriate. [Hint: Refer to implications of non-normality. Since y has a Binomial pdf, it is not normal].

TABLE B.5 99th Percentiles of the *F* Distribution (Table Entry Is *f* Such That Prob($F_{n_1, n_2} \leq f$) = 0.99)

n_1 = Degrees of Freedom for the Numerator									
n_2	1	2	3	4	5	6	7	8	9
1	4052.18	4999.50	5403.35	5624.58	5763.65	5858.99	5928.36	5981.07	6022.47
2	98.50	99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39
3	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35
4	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91
9	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35
10	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94
15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89
20	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46
25	7.77	5.57	4.68	4.18	3.85	3.63	3.46	3.32	3.22
30	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.07
40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89
50	7.17	5.06	4.20	3.72	3.41	3.19	3.02	2.89	2.78
70	7.01	4.92	4.07	3.60	3.29	3.07	2.91	2.78	2.67
100	6.90	4.82	3.98	3.51	3.21	2.99	2.82	2.69	2.59
∞	6.66	4.63	3.80	3.34	3.04	2.82	2.66	2.53	2.43

n_2	10	12	15	20	30	40	50	60	∞
1	6055.85	6106.32	6157.28	6208.73	6260.65	6286.78	6313.03	6313.03	6362.68
2	99.40	99.42	99.43	99.45	99.47	99.47	99.48	99.48	99.50
3	27.23	27.05	26.87	26.69	26.50	26.41	26.32	26.32	26.14
4	14.55	14.37	14.20	14.02	13.84	13.75	13.65	13.65	13.47
5	10.05	9.89	9.72	9.55	9.38	9.29	9.20	9.20	9.03
6	7.87	7.72	7.56	7.40	7.23	7.14	7.06	7.06	6.89
7	6.62	6.47	6.31	6.16	5.99	5.91	5.82	5.82	5.66
8	5.81	5.67	5.52	5.36	5.20	5.12	5.03	5.03	4.87
9	5.26	5.11	4.96	4.81	4.65	4.57	4.48	4.48	4.32
10	4.85	4.71	4.56	4.41	4.25	4.17	4.08	4.08	3.92
15	3.80	3.67	3.52	3.37	3.21	3.13	3.05	3.05	2.88
20	3.37	3.23	3.09	2.94	2.78	2.69	2.61	2.61	2.43
25	3.13	2.99	2.85	2.70	2.54	2.45	2.36	2.36	2.18
30	2.98	2.84	2.70	2.55	2.39	2.30	2.21	2.21	2.02
40	2.80	2.66	2.52	2.37	2.20	2.11	2.02	2.02	1.82
50	2.70	2.56	2.42	2.27	2.10	2.01	1.91	1.91	1.70
70	2.59	2.45	2.31	2.15	1.98	1.89	1.78	1.78	1.56
100	2.50	2.37	2.22	2.07	1.89	1.80	1.69	1.69	1.45
∞	2.34	2.20	2.06	1.90	1.72	1.61	1.50	1.50	1.16

SCHOOL OF AGRICULTURAL SCIENCES

2002/2003 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATIONS

AGE 462: AGRICULTURAL MARKETING AND PRICING

TIME: THREE HOURS

ANSWER FIVE QUESTIONS. QUESTIONS ONE AND TWO ARE COMPULSORY. CHOOSE ANY OTHER THREE QUESTIONS.

MARKS: AS GIVEN BELOW

1. Agricultural marketing is defined as “the performance of all business activities involved in the flow of goods or services from the point of initial agricultural production until they are in the hands of the ultimate consumer”
Elaborate on the various marketing functions and describe the specific requirements due to the nature of agricultural products.

(20 MARKS)

2. (a) Historically, farm prices have trended *downward* over a period of several decades. Nevertheless, farmers have continuously increased the quantity of production. Is this irrational behavior on the part of farmers? Assuming farmers’ rationality, how might we explain this phenomenon?

(10 MARKS)

- b) A Cooperative firm under the condition of perfect competition will operate at the same price and output level as a non-cooperative firm. Do you agree or disagree? Why?

(10 MARKS)

3. Markets may be categorized into four main categories. Describe **ONE** type of market and outline the price determination process under that market type.

(20 MARKS)

4. Write a critical essay on the problems and opportunities of agricultural marketing of any agricultural commodity or product in Zambia today.

(20 MARKS)

5. a) Under what conditions do products *move* from points or regions of surplus into regions of deficit for a commodity? Illustrate graphically.

(10 MARKS)

- b) What are the special characteristics of agricultural supply in general? Explain also why the price elasticity of agricultural supply changes with the period under consideration. (10 MARKS)

6. a) Does the term *pricing efficiency* imply *speed* of communication between producers and consumers? Should it?

(10 MARKS)

- b) What is the relationship of the costs of storage to the price variation that would be expected throughout the marketing year for storable commodity? For a non-storable commodity?

(10 MARKS)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – JANUARY 2003

AGE552

AGRICULTURAL EXTENSION EDUCATION

TIME: THREE HOURS

ANSWER: FIVE QUESTIONS. QUESTION ONE IS COMPULSORY

TOTAL MARKS: 100

1. As an Agricultural Extension expert at a District level in the Ministry of Agriculture and Co-operatives. You are to talk to Field Extension Staff on the importance of extension programme planning.
 - a) With an aid of a diagram, briefly describe the steps of an extension programme plan.
 - b) List four advantages of having a programme plan.
 - c) Who in your opinion should determine and plan extension programme in Zambia. Give reasons.
2. Discuss the theoretical basis upon which the T and V system was introduced. List the advantages and disadvantages associated with the system.
3. What is your understanding of diffusion of innovation? Clearly outline and briefly state the five factors that affect the rate of adoption.
4. Distinguish between a “ formative ” and “ summative ” evaluation. Explain fully the roles of extension evaluation as well as, listing the four basic parts involved in the process.
5. Define the concept Participatory Extension Approach. With at least three identified key features, critically assess the reasons for its use in Ministry of Agriculture Co-operative.
6. Communication is the basic precondition of any extension method. Explain the principles and main influencing factors of the process.

END OF EXAM

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURE

**2002/2003 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGE 562: INTERMEDIATE FARM MANAGEMENT

TIME: THREE HOURS

INSTRUCTIONS: THERE ARE FOUR QUESTIONS. ANSWER ALL QUESTIONS.

QUESTIONS 1.

- a. Explain what it means to be a “tenant at will”. [3]
- b. What requirements should a notice to terminate a farm tenancy satisfy? [3]
- c. A written notice to terminate a lease is personally delivered to the tenant on January 15, 2003, fixing termination of the lease on March 1, 2003. The leased ground is currently one-half in maize and the other half is to be planted to wheat (a winter crop). Is this proper notice? If so, when will the lease terminate? [5]
- d. Since a lease is a contract for the exclusive possession of land for a definite period, the land-owner cannot use the land for his own purposes while it is leased. Under what conditions can the land-owner enter the leased premises? List FIVE. [5]
- e. Any rent due on farmland is an automatic lien or encumbrance on the crops growing or harvested off the leased premises. Discuss this provision. [4]
- f. What are the essential elements of the farm income tax structure. Discuss using examples [6]

QUESTION 2.

- a. A farmer considering expansion of his cropping operations needs additional crop land. He chooses to rent additional land for cash payment. What are the THREE methods that he can use to begin the negotiations? Discuss the methods briefly. [12]
- b. In crop share rental agreements, why should the cost of yield increasing inputs be shared by the landowner and tenant and what would happen if either party pays none of the cost? [5]

c. As the farm manager for Chimsoro Inc. your management team has plans to buy a neighbor’s undeveloped farm to add to the land under the corporation’s control. What advice would you share with others concerning estimation of the amount of money your firm should pay to purchase the farm?[8]

QUESTION 3

- a. No matter how much time and effort is spent in setting up the compensation package, there are three basic principles all employers, large and small, should consider. Discuss each briefly. [12]
- b. Besides compensation, employers of skilled agricultural labor use several other factors to compete among themselves. Discuss TWO other factors apart from compensation.[5]
- c. When a farmer hires a person to do work for him/her, a legal relationship is established.
 - i. What characteristics must be present if a worker is to be considered an “*independent contractor*”, list NINE? [5]
 - ii. What costs will the employer avoid paying by contracting with an independent contractor instead of agreeing on an “*employer-employee*” relationship? [3]
 - iii. What are the key features of a “*principal-agent*” relationship? Discuss three briefly? [3]

QUESTION 4

- a. A farmer would like to purchase a tractor from an equipment dealer in town. The dealer sells tractors to qualifying buyers on loan but wants prospective buyers to pay a down payment of 10% of the value. Discuss the costs the farmer is going to incur from owning and operating this tractor? What are the tax implications of the decision to purchase the tractor to the farmer? [6]
- b. You are given the following information regarding a farmer who wants to lease a combine harvester for the next FIVE years.

Annual Lease Payment	K5million
Annual Fuel, Oil and Labor	K1 million
Lease payment inflation	10%
Variable costs inflation	10%
Marginal Income Tax Rate (MTR)	40%

- i. Derive the actual costs the farmer will pay each of the FIVE years.[10]
- ii. Determine the Present Value of costs for the FIVE year period at 30% discount rate.[5]

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

**2002/2003 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGE 572: AGRICULTURAL POLICY

TIME: THREE HOURS

**INSTRUCTIONS: -ALL QUESTIONS CARRY THE ASSIGNED MARKS.
-THE FIRST QUESTION IS COMPULSORY.
-PLEASE, FOLLOW THE INSTRUCTIONS IN EACH
SECTION**

SECTION I

Instructions: Answer question 1

1. The World Development Report [1991] argued, "that competitive markets are the best way yet found for efficiently organizing the production and distribution of goods and services."
 - a) Briefly discuss the underlying assumptions behind this argument. (10 marks)
 - b) Briefly discuss and illustrate the conditions that must be fulfilled for the above argument to hold. (10 marks)
 - c) Discuss the rationale for government intervention. (20 marks)
-

Section II

Instructions: Answer question 2 and one other question from section

2. Concerns for food insecurity is often used to justify government intervention in the agriculture sector.
 - a) Briefly define food insecurity and the various forms it occurs. (10 marks)
 - b) Briefly discuss the relevant policies to deal with food insecurity. (10 marks)
3. Many donors complain that Zambia has no agricultural policy. As a new agricultural economist in the Ministry of Agriculture and Cooperatives, the Director has requested you to prepare a speech for the Minister to be presented before Donors. (20 marks)

4. Briefly discuss the importance of the following in agricultural policy formulation:
 - a) Goals (5 marks)
 - b) Values (5 marks)
 - c) Economic growth (5 marks)
 - d) The agriculture sector has many stakeholders. Discuss the relevance of the
Zambian agricultural policy objectives to the key stakeholders. (5 marks)
-

SECTION III

Instructions: Answer question 5 and one other question from section

5. Upon graduation, the Ministry of Agriculture and Cooperatives has posted you to Kawambwa District. Assuming the government wants to promote production on the basis of comparative advantage of agricultural products, discuss how you would identify the products to focus on. (20 marks)
6. The IMF and the World Bank would like the government to reduce its involvement in the agriculture sector. Briefly discuss:
 - a) The general arguments that are used to support this position (10 marks)
 - b) The roles of the government (5 marks)
 - c) The causes of government failure (5 marks)
7. In 2003, Zambia produced a bumper harvest of maize. The Minister needs to make a decision on the stock levels FRA should maintain. As a new graduate, the Minister has requested you to prepare a paper to review the key issues pertaining to the maintenance of food reserves. (20 marks)

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER FINAL EXAMINATION, JANUARY, 2004

AGE 582: PROJECT MONITORING AND EVALUATION

TIME: THREE HOURS

INSTRUCTIONS:

ANSWER ALL QUESTIONS. EACH QUESTION IS WORTH 20 MARKS.

- Q1. a) Monitoring and Evaluation (M & E) are of critical importance in realizing the objectives of agricultural development projects. Define the terms “Monitoring” and “Evaluation” and comment on the distinction between monitoring and evaluation.
- b) In Zambia M&E is conducted at the project and sectoral levels. Outline the main reasons that underpin the importance of sectoral analysis.
- Q2. The Formal Evaluation process focuses on the following areas: performance, outputs, effects, impact and economic and financial efficiency. The assessment of performance when broadly defined includes a review of all the activities undertaken by the project to achieve its stated objectives. Briefly elaborate on at least five components usually covered in an evaluation of project/program performance.
- Q3. a) Elaborate briefly what Quasi- Experimental (QE) designs are and how they can be applied to evaluate the impacts of development programmes/projects.
- b) Explain three disadvantages that may be associated with QE design of evaluating development programmes/projects.
- c) Explain three ways to strengthen less robust QE designs.

- Q4. Participatory Evaluation (PE), among other things, involves the participation of stakeholders and beneficiaries of a programme or project in the collective examination or assessment of a programme/project.
- a) Briefly explain why Participatory Evaluation is considered different from conventional evaluation.
 - b) Briefly explain four functions of Participatory Evaluation.
 - c) Briefly explain four broad principles of Participatory Evaluation.
- Q5. Write brief notes explaining the main differences between:
- a) Mono-method Approaches and Multi-method Approaches.
 - b) Single-Site Analysis and Cross-Site Analysis.
 - c) Longitudinal Studies and Cross-Sectional Studies.
 - d) Effects and Impacts.
 - e) Qualitative methods and Quantitative methods.

END OF EXAMINATION

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

SECOND SEMESTER EXAMINATIONS - JANUARY 2004

AGF 342 (THEORY PAPER) – FOOD TOXICOLOGY

INSTRUCTIONS

1. TIME: THREE HOURS
 2. ANSWER ANY FIVE QUESTIONS
-

1. (a) Cycasin is one of the food-derived naturally occurring carcinogens. Elaborate. **9 MARKS**

(b) Which two hydrazines are of importance in mushrooms and why? **6 MARKS**

(c) Gossypol, euricic acid and cetoleic acid are constituents of lipids. Discuss each one of them, highlighting their toxicity and the symptoms they cause. **5 MARKS**
2. (a) What is Refsum's Syndrome and its symptoms? Is it reversible? Explain. **5 MARKS**

(b) Inborn errors in carbohydrate metabolism cause diseases. Give two examples of inborn errors which cause diseases and the symptoms due to these diseases. **3 MARKS**

© Puffer fish poisoning and scombroid toxicity are different except for the fact that they are both caused by marine fish. Give brief notes on each. **7 MARKS**

(d) Paralytic shellfish poisoning and ciguatera poisoning are both due to toxins produced by species of dinoflagellates. Explain each type of poisoning. **5 MARKS**
3. (a) *Staphylococcus aureus* is one of the major causes of food intoxications, what is food intoxication? What are the sources of contamination and the conditions that would encourage this *Staphylococcus* intoxication? What measures can be taken to prevent *Staphylococcus aureus* intoxication? **8 MARKS**

(b) *Clostridium botulinum* is a gram-positive, spore-forming rod that produces toxins. Discuss the stability and the characteristics of the botulinal toxins and the conditions that would encourage botulism. What are the symptoms of

botulism and what are the measures which can be taken to prevent it? **12 MARKS**

4. (a) Numerous moulds are capable of producing toxic metabolites in food products, mycotoxins. What are their chemical characteristics, substrates and their biological activity? To prevent mycotoxicoses what measures can be taken? **14 MARKS**
- (b) Discuss the enterotoxin of *Bacillus cereus* and the conditions for intoxication caused by it. What are the symptoms of this intoxication? **6 MARKS**
5. (a) What is a bacterial food infection? *Salmonella* can have 4 types of antigens, which are these? What are the symptoms of salmonellosis and what measures can be taken to prevent salmonellosis? **8 MARKS**
- (b) *Listeria monocytogenes* occurs both among human beings and animals as in the environment. As such for listeriosis to be caused to human beings certain conditions have to be favourable, list them and the measures which can be taken to prevent listeriosis. **6 MARKS**
- © *Vibrio cholerae* and *Shigella* have differences and similarities. Compare their toxins, sources of contamination, the conditions of infection and their preventive measures. **6 MARKS**
6. (a) What are food additives? Give three categories and examples in those categories. Explain the function(s) of each category, their characteristics/properties and regulations governing their use. **9 MARKS**
- (b) What is a trace element? List the ten essential elements giving examples of their biochemical functions and also indicate which one among the trace elements is both an essential element as well as being a poison. **9 MARKS**
- (c) List all the trace elements which are not essential and indicate their apparent roles. **2 MARKS**
7. (a) What are the similarities and differences between Polycyclic Aromatic Hydrocarbons and N-nitroso compounds. Give the structures of the most commonly detected in cooked foods. **9 MARKS**
- (b) N-nitroso compounds could be formed outside the body or synthesized in vivo. Describe how they are formed in both cases. What is the basis for the carcinogenicity of nitrosamines and which are the sites of carcinogenicity? **6 MARKS**

- © List the methods of minimizing exposure to PAHs and N-nitroso compounds respectively. Why is it prudent to minimize the dietary exposure to PAHs? **5 MARKS**
8. (a) What is a 'true' food allergy? How are allergens similar to as well as different from any other antigens? Give brief notes on some very broad characteristics common to several food allergens and what is peculiar about many of these characteristics/properties? **8 MARKS**
- (b) Cow's milk is one of the most common food allergens. List the major allergens giving brief notes on each. **4 MARKS**
- © The consumption of fish is a frequent cause of IgE mediated reactions? Discuss the major allergens in Cod and the most important major allergen in shrimp. **4 MARKS**
- (d) Avoidance is the only accepted form of food allergen therapy, how come avoidance sometimes does not work? **4 MARKS**
9. (a) Synthetic organic insecticides can be placed into three classes, based on molecular structure and composition. List the three classes giving two examples of insecticides in each class. Describe the toxicity of each class. **6 MARKS**
- (b) It is usually true that insecticides highly toxic to experimental animals are highly toxic to man. How are they toxic to experimental animals thus to man? **5 MARKS**
- © What is the principal source of lead for the general population and why? The chemical form of lead is an important factor affecting its biological behaviour in the body. Explain. The toxic action of lead in the body has been traced in part even though this may not be the only toxic effect. Describe this toxic action. Lead retained in the body and accumulates in a specific part of the body, which part is this and why does this accumulated lead cause concern? **6 MARKS**
- (d) Mercury is considered to get into food by two routes. Which are these routes and how does mercury end up getting into the food? Mercury is said to be amplified in the food chains. Explain what this amplification is and how it occurs. **3 MARKS**

-----*End of Exam*-----

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

SECOND SEMESTER EXAMINATIONS - JANUARY 2004

AGF 352 – FOOD MICROBIOLOGY

INSTRUCTIONS

- 1. STRICTLY FOLLOW THE ORDER OF THE QUESTIONS WHEN ANSWERING.**
 - 2. READ CAREFULLY QUESTIONS BEFORE ANSWERING.**
 - 3. ANSWER ALL QUESTIONS.**
-

QUESTIONS

1. When an outbreak due to foodborne disease occurs in which a number of individuals have consumed the same contaminated foodstuff, the result and symptoms can vary in severity from possible fatality to mild or no illness. Give a detailed explanation of the various factors that can be responsible for such variability (15 pts).
2. Some students have consumed leftover dishes of rice, meat and vegetables. After 6 to 12h they start experiencing abdominal pains, vomiting and diarrhoea. As a food microbiologist, you are asked to give guidance in order to find out what could be the pathogenic microorganism(s) involved. Develop your answer mentioning all the possible pathogenic microorganisms that could be involved as well as their respective mechanisms? (15 pts)
3. Write an essay of the importance of 'education' in the prevention of foodborne illness. Your answer should make reference to education at school, in the home, and in the workplace (15pts).
4. What are the most important intrinsic factors that govern microbial growth? How is the microbial growth affected when these factors are changed? Sustain your answer with a graphical representation. (15 pts)

5. You are given a 10^3 dilution of a suspension of *coliforms*. You then make two successive 1/100 dilutions of this dilution. From the last dilution you make, 0.1 ml is added to a petri dish containing 10 ml of solidified bottom agar and spread over the surface by using a glass rod. After spreading the 0.1 ml aliquot, a top layer of 3ml molten agar (overlay) is poured onto the surface of the bottom agar. After incubation, 44 colonies are counted.
- a. To help you organize your data, the following can be found out
 - i. Initial dilution of *Coliforms*
 - ii. Subsequent dilution of phage:
 - iii. Amount inoculated from last dilution.
 - b. Does the amount of bottom agar matter in the calculations?
 - c. Does the amount of overlay matter in the calculations?
 - d. Determine the number of colony forming units (CFUs) per ml of the original *Coliforms* suspension (20pts).
6. Discuss the importance of food poisoning related to health, economic loss and tourism in developing country context (20 pts).

-----*End of Exam*-----

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
FOOD SCIENCE AND TECHNOLOGY DEPARTMENT

SECOND SEMESTER EXAMINATION- JANUARY 2004

FOOD EVALUATION AGF: 362

INSTRUCTION: ANSWER ALL QUESTIONS

DURATION OF EXAM: THREE HOURS

1. (a)What are the principle uses of sensory techniques, and what is the primary function of sensory testing **(3 Points)**
(b) Define flavour as it relates to food, beverages and seasonings. **(3 Points)**
2. On human subjects as subjects. Name the 4 factors that govern any measurement explain briefly about each factor. **(4 Points)**
3. Name four attributes that human beings tend to perceive in food. **(4 Points)**
4. Mention 5 characteristics that are associated with appearance **(5 Points)**
5. What are the 3 characteristics associated with consistency, and texture perceived in the mouth other than test and chemical feelings. **(3 Points)**
6. Define the following
 - (a) Olfaction **(3 Points)**
 - (b) Gustation **(3 Points)**
 - (c) Threshold, What is significant about it? **(4 Points)**
7. The most used methods of measuring sensory responses to a sample are in the order of sensory intensity Name 3. Explain how each one operates.**(5 points)**
8. When is the triangle test method used, mention its limitations and mention areas where it has been found effective.**(6 Points).**

9. Why is it important to control the many variables during sensory evaluation? Mention and describe the groups under which these variable are grouped (5 Points)
10. On Test Room Design explain what the following should fulfil at least two conditions for each from (a-e) (10 Points)
- (a) The booth
 - (b) Descriptive evaluation and training area
 - (c) Preparation area
 - (d) Entrance and exit area
 - (e) Storage area
11. Name and describe the 4 heading under which sensory data falls. You can use graphics to illustrate your answer (10 Points)
12. (a) What is psychophysical theory? Why is it important? Name without explaining 2 such laws that fall under this theory (5 Points)
- (b) What is the other name for the Pair wise ranking test what does it measure? Describe its scope and application (5 Points)
13. Define the following (2 Points each)
- (a) Colour blindness
 - (b) Anosmia
 - (c) Ageusia
 - (d) Somesthetic
 - (e) Kinesthetic
14. What do attribute difference tests measure (2 Points)
15. Give the scope and application of the simple difference test. What makes it particularly different from the Triangle and Duo- Trio tests? Where is it effective? What are its limitations? (10 Points)

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

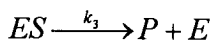
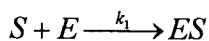
SECOND SEMESTER EXAMINATIONS - JANUARY 2004

AGF 431 – FUNDAMENTALS OF BIOCHEMICAL ENGINEERING

INSTRUCTIONS

1. ANSWER ALL QUESTIONS
 2. OPEN BOOK EXAM. NOTES CAN BE USED BUT NOT EXERCISES OR RESOLVED PROBLEMS.
-

1. Explain how Biochemical engineering can be used in order to:
 - a. Produce amino acids.
 - b. Treat wastes from food industries.Design you own scenario in each case. Discuss extensively and support your argument with practical examples. (15pts)
2. You have to conduct a biochemical process meant at hydrolysing corn starch for obtaining fructose using a biocatalyst. All the three - biocatalyst, enzyme and microorganism are available for the process.
 - a. Which biocatalyst will you choose? Why?
 - b. Explain you answer quoting the pro and cons for each choice. In other words what are the advantages and disadvantages of each choice in term of activity and performance. (15pts).
3. When glucose is converted to fructose by glucose isomerase, the slow product formation step is also reversible as:



- Derive the rate equation by employing
- a. Michaelis –Menten and
 - b. The Briggs-Haldane approach.
 - c. Explain when the rate equation derived from by the Briggs-Haldane approach can be simplified to that derived by the Michaelis-Menten approach. (20 pts)

4. From a series of batch runs with a constant enzyme concentration, the following initial rate data were obtained as a function of initial substrate concentration

Substrate concentration mmol/l	Initial reaction rate mmol/l min
1	0.20
2	0.22
3	0.30
5	0.45
7	0.41
10	0.50
15	0.40
20	0.33

- Evaluate the Michaelis-Menten kinetic parameters by the Lineweaver-Burk plot and the Eadie-Hofstee plot. In evaluating the kinetic parameters, do not include data points, which deviate systematically from Michaelis-Menten model and explain the reason for the deviation.
 - Discuss the strength and the weaknesses of each method.(20 pts)
5. Calculate the steady-state substrate and biomass concentration in a continuous fermenter that has an operating volume of 25 l when the sterile feed stream contains limiting substrate at 2000 mg/l and enters the vessel at 8l/h. The values of K_s and μ_{\max} are 10.5 mg/l and 0.45h⁻¹, respectively, and the yield coefficient may be taken to be 0.48. (20 pts)
6. Derive the relationship giving the change with respect to time of cell concentration in a batch fermenter.(10 pts).

-----End of Exam-----

UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS - JANUARY 2004

AGF 432/MM 452

PROCESS CONTROL AND INSTRUMENTATION

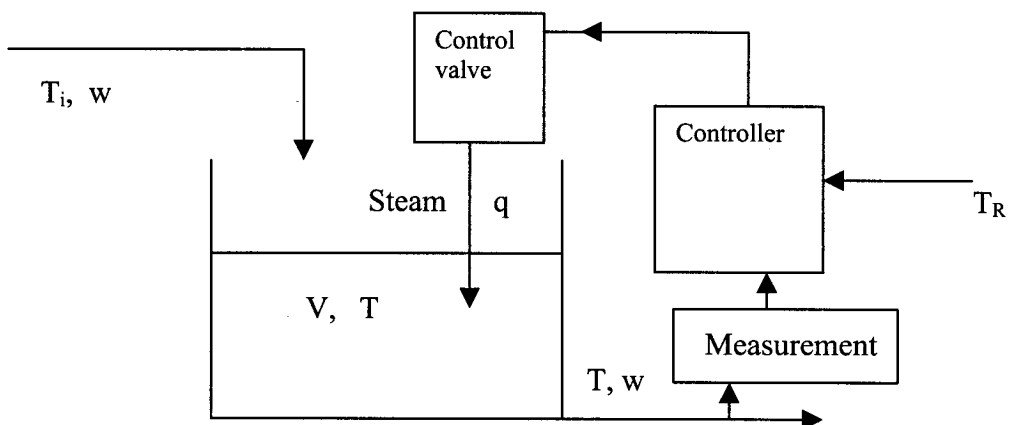
TIME : THREE HOURS

**INSTRUCTIONS: ANSWER
 THE ONE QUESTION IN SECTION A
 ONE QUESTION FROM SECTION B
 THREE QUESTIONS FROM SECTION C**

**All additional data that the student will require are attached.
All questions carry equal marks**

SECTION A

1. (i) In the home, the geyser has a temperature setting, a thermostat to measure the actual temperature of the water and the error, and a heating element. Draw a block diagram of this feedback process. What type of controller does this system have?
- (ii) Draw a block diagram for the control system generated when a human being steers a vehicle in relation to the lane marking on the street.
- (iii) Consider the stirred-tank heater that we have discussed during lectures. The control valve supplies steam. The system is shown in the figure below.



- (a) What is the objective of this control strategy?
(b) What is the measured output?
(c) What is the manipulated input?

- (d) What is a possible disturbance and how does its increase affect the manipulated input?
- (e) Is this a continuous or batch process?
- (f) Should the control valve fail-open or fail-closed? Is this valve air-to-open or air-to-close? Is the valve gain positive or negative?
- (g) Draw the schematic control block diagram.
- (h) Suppose you wanted to use feedforward control. Construct the schematic control block diagram in this case.

SECTION B

2. (i) Solve the equation

$$x \frac{dy}{dx} + 2y = 3x - 1 \text{ given that when } x = 2, y = 1.$$

- (ii) Using Laplace transforms or otherwise, solve the equation

$$\frac{d^2x}{dt^2} + 3 \frac{dx}{dt} + 2x = 3\sin t, \text{ given that } x(0) = 0 \text{ and } x'(0) = 0.$$

3. (i) Solve the equation

$$(x + 1) \frac{dy}{dx} + y = (x + 1)^2, \text{ given that when } x = 0, y = 0.$$

- (ii) Using Laplace transforms or otherwise, solve the equation

$$\frac{d^2x}{dt^2} - 3 \frac{dx}{dt} + 2x = \sin t, \text{ given that } x(0) = 0 \text{ and } x'(0) = 0.$$

SECTION C

4. (i) Sketch the following function and give its Laplace transform:

$$f(t) = 3tu(t) - 3u(t-1) - u(t-2)$$

- (ii) The transfer function of the thermometer reading is given as

$$\frac{Y(s)}{X(s)} = \frac{1}{\tau s + 1}$$

- (a) A thermometer is initially at 30°C. It is immersed in a bath at 80°C at $t = 0$. The temperature reading after 1 minute is 62°C. Determine the time constant of the thermometer.

- (b) If at $t = 2\tau$ minutes, the thermometer is removed from the bath and quickly placed in a bath at 60°C, determine the maximum temperature indicated by the thermometer. What will be the ultimate indicated temperature?

- (iii) Solve the following equation for $x(t)$:

$$\frac{dx}{dt} = \int_0^t x(t) dt - 2t, \text{ where } x(0) = 1.$$

5. A step change of magnitude 8 is introduced into the transfer function

$$\frac{Y(s)}{X(s)} = \frac{4}{(s^2 + 4s + 16)}$$

Determine

- (i) the overshoot ratio,
 - (ii) the decay ratio,
 - (iii) the maximum value of $Y(t)$,
 - (iv) the rise time,
 - (v) the peak time,
 - (vi) the ultimate value of $Y(t)$,
 - (vii) the period of oscillation.
6. A process openloop transfer function between the controlled variable and the manipulated variable is given by

$$G_2 = \frac{K_p}{\tau_p s + 1}$$

The associated lag with temperature measurement is first order with a time constant of τ_m . A proportional-only controller is used. Assume the transfer function of the final control element is unity.

- (i) Draw the block diagram of this temperature feedback control system.
- (ii) Derive the transfer function for a set point change.
- (iii) For $K_p = 1$, $\tau_p = 10$, calculate the corresponding value of controller gain K_c that will give a damping factor of 0.707 when
 - (a) $\tau_m = 1$, and
 - (b) $\tau_m = 5$.
- (iv) For $\tau_m = 1$ and a unit step change in set point, determine the offset.

7. A process openloop transfer function between the controlled variable and the manipulated variable is given by

$$G_2 = \frac{K_p}{(\tau_p s + 1)^2}$$

The control valve and the measurement element transfer functions are both unity. *If a PI controller is used,*

- (i) Draw the block diagram of this system using standard symbols.
- (ii) *If τ_l is set equal to τ_p ,* calculate
 - (a) the value of the controller gain K_c , in terms of K_p , that gives a closedloop damping factor of 0.707,
 - (b) the closedloop time constant, in terms of τ_p , using this value of gain,
 - (c) the overshoot ratio,
 - (d) the steady-state error for a unit step change in the set point variable.

END OF EXAMINATION IN AGF 432/MM 452

Additional information to assist the students in this examination follows.

Response of second order system

The **unit-step response** for the underdamped **standard** second order system is:

$$Y(t) = 1 - \frac{1}{\sqrt{1-\zeta^2}} e^{-\zeta t/\tau} \sin \left(\sqrt{1-\zeta^2} \frac{t}{\tau} + \tan^{-1} \frac{\sqrt{1-\zeta^2}}{\zeta} \right)$$

Table of Laplace Transforms

$\frac{f(t)}{u(t)}$	$\frac{f(s)}{\frac{1}{s}}$	$\frac{f(t)}{tu(t)}$	$\frac{f(s)}{\frac{1}{s^2}}$
$t^n u(t)$	$\frac{n!}{s^{n+1}}$	$e^{-at} u(t)$	$\frac{1}{s+a}$
$t^n e^{-at} u(t)$	$\frac{n!}{(s+a)^{n+1}}$	$\sin kt u(t)$	$\frac{k}{s^2 + k^2}$
$\cos kt u(t)$	$\frac{s}{s^2 + k^2}$		

Inversion by partial fractions

METHOD 1

Suppose $L\{x(t)\} = x(s) = \frac{F(s)}{(s+k_1+jk_2)(s+k_1-jk_2)}$

where $F(s)$ is some real function of s .

Let the function $x(s)$ after partial fraction expansion become

$$x(s) = F_1(s) + \left(\frac{a_1 + jb_1}{s+k_1+jk_2} + \frac{a_1 - jb_1}{s+k_1-jk_2} \right)$$

where a_1 and b_1 are constants evaluated in the partial fraction expansion and $F_1(s)$ is a series of fractions arising from $F(s)$.

Then the inverse transform arising from the complex roots reduces to

$$2e^{-k_1 t} (a_1 \cos k_2 t + b_1 \sin k_2 t)$$

METHOD 2

Suppose $x(s)$ after partial fraction expansion becomes

$$x(s) = F_1(s) + \frac{Bs + C}{(s + a)^2 + k^2}$$

Then

$$x(s) = F_1(s) + B \frac{s + a}{(s + a)^2 + k^2} + \left(\frac{C - aB}{k} \right) \frac{k}{(s + a)^2 + k^2}$$

The inverse transform arising from the above becomes

$$x(t) = F_1(t) + B e^{-at} \cos kt + \left(\frac{C - aB}{k} \right) e^{-at} \sin kt$$

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
FOOD SCIENCE AND TECHNOLOGY DEPARTMENT

SECOND SEMESTER FINAL EXAMINATION-JANUARY 2004
FOOD PACKAGING: AGF 442 THEORY PAPER

1. Define the following **(3 Points Each)**
 - (a) Epoxy resins
 - (b) Monomer
 - (c) Glass Temperature T_g , also known as Glass transition temperature as described in packaging.
 - (d) Global migration.
2. What are additives as described in packaging? **(3 Points)**
3. Explain the origin of metals used in packaging and explain how they are formed. **(3 Points)**
4. What is corrosion **(2 Points)** and explain the corrosion mechanism caused by
 - (a) Galvanic **(5 Points)**
 - (b) Chemical **(5 Points)**Explain how these corrosion mechanisms can be stopped. **(1Point)**
5. What are the three methods used in pulping briefly explain how each one operates. **(3 Points)**
6. What problems do littering of plastics pose apart from spoiling the beauty of nature? Describe 3 modern techniques being use to overcome what you have just described **(7 Points)**
7. In paper production paper unlike glass cannot be recycled indefinitely why? **(3 Points)**
8. Name the three types of open food and beverage cans used in the food industry **(3 Points)**
9.
 - (a) How are Completely synthetic plastics classified **(6 Points)**
 - (b)What is fibrillation? How does it affect the quality of paper? **(3 Points)**
 - (c)Name 3 high molecular elements existing in nature **(3 Points)**

10. What is pyrolysis? **(2 Points)**. What products are released as a result of pyrolysis of the following
- (a) Pyrolysis of products containing chlorine (PVC, PVDC) (name all) **(3 Points)**
 - (b) Pyrolysis of thermoplastics like (PE, PS, PP) **(1 Point)**
 - (c) What product is justifiably treated by pyrolysis **(1 Point)**
11. (a) What is the difference between the reactions leading to the formation of a polymer compound and a polycondensate, **(2 Points)**
- (b) Write these in full HDPE LDPE what is the difference between the two **(10 Points)**
12. Discuss all possible problems you learnt related to plastic recycling. Where it has been done what type of recycled plastic is produced and what is it used for. **(6 Points)**
13. On the softening and glass temperature T_g on HDPE,
- (a) What percentage constitutes the crystalline and amorphous states respectively **(2 Points)**
 - (b) Explain how the crystalline and amorphous areas affect the quality of the plastic. **(2 Points)**
 - (c) When the T_g of a plastic is higher than room temperature what quality characteristics will the plastic have. **(2 Points)**
14. The Food Additives Amendment of 1958 also known as the Delaney clause affected food and packaging materials for food. Explain how packaging was affected in terms of intended and unintended food additives. According to this law are packaging materials treated as food additives? **(10 Points)**

THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – SEMESTER II 2003
METHODS IN FOOD ANALYSIS II – AGF 452

TIME: 3 HOURS

ANSWER ALL THE QUESTIONS:

1. (a) A series of potassium standards gave the following emission intensities at 404.3 nm.

<u>Sample ($\mu\text{g K/mL}$)</u>	<u>Relative emission</u>
Blank	2
5.0	124
10.0	243
20.0	486
30.0	712
Unknown	417

- (i) Calculate the concentration of potassium in the unknown.
 - (ii) Three blank readings were made and gave values 2, 3 and 5.
From these data, estimate the Limit of Detection (LOD), the Reliable Detection Limit (RDL) and the Limit of Quantitation (LOQ) for the experiment.
- (b) Discuss one method for pre-concentrating analytes in order to improve sensitivity in Atomic Absorption Spectroscopy (AAS).
- (c) With the aid of a sketch, describe the operation of an Inductively Coupled Plasma (ICP) torch in atomic spectroscopy.
- (d) Why is the source (Hollow Cathode Lamp) made of an element of the analyte of interest in the sample in AAS?
2. (a) Distinguish between potentiometry and voltammetry.
- (b) The pH meter is a versatile tool in almost all laboratories. Describe the principle behind its operation with the aid of sketches where necessary.
- (c) Discuss the advantages of using mercury as an electrode in polarography instead of solid electrodes such as platinum.

- (d) Cd^{2+} was used as an internal standard in the analysis of Pb^{2+} by differential pulse polarography. Cd^{2+} gives a reduction wave at -0.60 V and Pb^{2+} gives a reduction wave at -0.40 V. It was first verified that the ratio of peak heights is proportional to the ratio of concentration over the whole range employed in the experiment. Results for known and unknown mixtures are given below.

Analyte	Concentration (M)	Current (μA)
Known		
Cd^{2+}	3.23×10^{-5}	1.64
Pb^{2+}	4.18×10^{-5}	1.58
Unknown + Internal Standard		
Cd^{2+}	?	2.00
Pb^{2+}	?	3.00

The unknown mixture was prepared by mixing 25.00 mL of unknown (containing only Pb^{2+}) plus 10.00 mL of 3.23×10^{-4} M Cd^{2+} and diluting to 50.00 mL. Calculate the concentration of Pb^{2+} in the undiluted solution.

3. (a) With the aid of sketches, distinguish between X-ray fluorescence and X-ray absorption.
- (b) Derive the Bragg equation for the relationship of the X-ray wavelength and the distance between crystal planes in a crystal.
- (c) Briefly describe the principle behind Electron Spectroscopy for Chemical Analysis (ESCA).
- (d) Describe the mechanism of production of the MNN Auger electron.
4. (a) How would you theoretically describe a ray of polarized light? What causes rotation when polarized light passes through an optically active compound?
- (b) Distinguish between Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC).
- (c) Distinguish between the following:
 - (i) Quality Assurance and Quality Control
 - (ii) Instrument Detection Limit (IDL) and Method Detection Limit (MDL)
- (d) Outline the steps including formulas for determining the MDL of a method.

**UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

**SECOND SEMESTER EXAMINATIONS – JANUARY 2004
TECHNOLOGY OF MEAT AND FISH (AGF 512) THEORY PAPER**

INSTRUCTIONS: ANSWER ANY THREE (3) FROM SECTION A AND ANY 3 FROM SECTION B

DURATION: THREE HOURS

SECTION A

1. (a) The definition of meat is usually restricted in one way but is often widened in another. What is meat? **4 MARKS**

(b) Proteins in muscles can be divided into three broad categories. Which are these categories? List the proteins according to the categories they fall into and the functions of any five proteins. **10 MARKS**

(c) Soluble, non-protein substances make up about 3.5% of meat. List these substances. **2 MARKS**

(d) There are two main reasons why preslaughter handling is of importance. What are these reasons? What is preslaughter handling, its time frame and what does it involve? **4 MARKS**
2. (a) There are two very important constituents of meat which when lost before slaughter by an animal will affect the final product. Which are these two and how do they affect the meat obtained when the animal is slaughtered? **8 MARKS**

(b) Slaughter is normally a two stage process. Which are the two stages? List the methods used in each of the stage explaining what is involved in each case. **12 MARKS**
3. (a) Stoppage of the circulation in muscle tissue leads to the failure of five main systems and the failure of these five systems will finally end in five main results. List the five main systems which fail and the five main results of this failure. **6 MARKS**

(b) What are the most important characteristics of post-mortem glycolysis? **4 MARKS**

- (c) Describe rigor mortis and the patterns used to classify its onset. **10 MARKS**
4. (a) What is conditioning? Discuss the two most important processes which make up conditioning. **14 MARKS**
- (b) List the other chemical changes which take place during conditioning. **6 MARKS**
5. (a) Texture and tenderness are presently rated the most important attributes to eating quality of meat. What is texture? Give brief notes on how tenderness is affected by preslaughter factors and any two post slaughter factors. **14 MARKS**
- (b) The quantity and chemical nature of myoglobin affect the appearance of the meat surface. Explain. **6 MARKS**
6. (a) Broadly speaking, there are three categories of ingredients which meat curing and fermented meat products share between them.
- (i) Ingredients common to both with similar functions in the two processes
 - (ii) Ingredients common to both with different functions in the two processes
 - (iii) Ingredients with functions only peculiar to the specific process.
- List all the ingredients giving the functions for each in both processes in the three respective categories. **14 MARKS**
- (b) Describe the mechanism of nitrosomyoglobin formation and how the stability of the red colour of bacon is enhanced. **6 MARKS**

SECTION B: AGF 512 FISH TECHNOLOGY

INSTRUCTION: ANSWER ANY THREE ALL QUESTIONS CARRY (20 POINTS)

1. (a) Chilling of fish retards deterioration. What deterioration activities are we concerned about? Explain how they affect the quality of fish. What factor seems to propel them most? (**10 Points**)
- (b) Fresh water fish keeps longer than marine, tropical fish keeps longer than temperate fish and nonfat fish keeps longer than fatty fish. This statement is explained by various theories explain why this is so for each situation as postulated by the theories.(**10 Points**)

2. (a) What is MAP. Explain its significance in food packaging and shelflife. Mention the gasses used in MAP Explain how each gas helps in maintaining product quality What microorganisms are affected by each gas. **(10 Points)**

 (b) In canning of foods food is divided into 3 pHs. Mention and describe the significance of each pH and mention the food products that can be processed in each pH and microorganisms of concern **(10 Points)**
3. (a) What is precooking of fish in fish technology? Why is it important? List the 5 advantages of precooking. **(10 Points)**
 (b) What is thaw-drip, explain how it comes about in fish. Explain how quality is affected. How different is this from growth of crystals as quality factor. In your answer compare and contrast quality factors affected in both cases. **(10 Points)**
4. Mention and describe all the salting methods in fish technology. Describe the significance and what is involved in each method. Mention the types of salt used. Describe the factors affecting the salting process. Why is it done and what are the benefits of salting fish. Mention one type of fish, which is, salted in Zambia. **(20 Points)**
5. (a) Mention and describe the four factors affecting the frozen storage of fish. Explain how each affects the quality of fish. **(5 Points)**
 (b) Mention and describe 3 advantages and disadvantages of thawing under flowing water **(5 points)**

 (b) Describe the freezing process explain what happens at the first stage, second stage and third stage. Explain how the rate of freezing affects the quality of fish and explain how significant this is to fish keeping quality. **(10 Points)**
6. Define or describe the following
 - (a) Flat sour spoilage and what causes it **(3 Points)**
 - (b) 12 D-concept where is it applied **(3 Points)**
 - (c) Dun spoilage and what is this spoilage associated with and what causes it **(6 Points)**
 - (d) Cold smoking temperature and hot smoking temperature what are they? What is achieved at these temperatures **(8 Points)**

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

SECOND SEMESTER EXAMINATIONS- JANUARY 2004

AGF 522 -TECHNOLOGY OF FERMENTED FOODS

TIME: THREE HOURS (3 HOURS)

INSTRUCTIONS: Section 1 is compulsory. In Section 2, you choose any 4 questions

SECTION 1

A small Dairy plant has a problem with Cheddar cheese and yoghurt manufacture. "The milk is not curding". As a fifth year student studying Food Science and Technology you have been hired as a consultant to solve the problem.

- a) What could have been the possible cause(s) of the problem? (8 marks)
- b) Describe the process you would advice the company to use for manufacture of set yoghurt (10 marks)
- c) Explain the importance of starter cultures in food fermentation (2 marks)

SECTION 2

1. Fermentation is one of the oldest technologies and it is widely used in food processing.
 - a) Explain why it is a method of choice and discuss the advantages of the technology (5 marks)
 - b) Outline the factors that control growth and activity of micro-organisms in food fermentation (5 marks).
2. Lactic acid bacteria are commonly used in food fermentation.
 - a) Give reasons why these micro-organisms are known as fastidious (2 marks)
 - b) What role(s) do these micro-organisms play in food fermentation? (2 marks)
 - c) With reference to lactic acid bacteria discuss what is meant by homofermentation and herterofermentation (6 marks).

3.
 - a) List the major classes of wines and briefly explain their major differences (5 marks)
 - b) Define Malo-lactic fermentation and explain its importance in wine marking (5 marks)
- 4) Malt is an important raw material in the production of beer like Masi larger.
 - a) Briefly explain the steps involved in preparation of malt from barley (6 marks)
 - b) Non-alcoholic cereal based fermented beverages are very popular among the African society. Giving a particular example discuss the socio-economic benefits of these beverages (4 marks).
5. With reference to a specific example discuss solid state fermentation (10 marks).

**THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

SECOND SEMESTER EXAMINATIONS – JANUARY 2004

AGF 532 - TECHNOLOGY OF PLANT PRODUCTS II

TIME: THREE HOURS

INSTRUCTIONS: Answer all questions, each section to be answered in a separate answer booklet.

SECTION A

1. A number of ingredients are used in the production of soft drinks. Outline the major classes of ingredients used in the production of soft drinks, define each and give the function(s) of each in a soft drink.

(20 marks)

2. Outline the major operations and equipment used in the production of citrus fruit juices from fruits. Include brief notes on harvesting and pre extraction processing.

(20 marks)

SECTION B

3. One of the important steps in the processing of sugar cane is refining of the crude juice into the thin juice.

I. Why is it necessary to purify the crude juice (Thick juice)?

II. Give and explain the reactions involved in the refining of the crude juice.

(20 marks)

4. The crystallization of thin juice is a critical stage in the processing of cane and beet sugar.

- I. Show and explain the graph (Sucrose concentration vs. Temperature) of the supersaturation of a sugar solution (Thin juice during crystallization in the processing of beet sugar).
- II. Give the two methods utilized to induce crystal growth during crystallization?
- III. What is compound imbibition?

(20 marks)

5.

- I. Explain the two important oxidation reactions of the catechins during the fermentation of black Tea.

(4 marks)

- II. Describe the process of withering, explaining the processes occurring?

(4 marks)

- III. What are polyphenols and what are their functions in black Tea?

(4 marks)

- IV. What is decaffeination and how is it done during the processing of Coffee?

(4 marks)

- V. What are the causes of browning in Irish and sweet potatoes during processing and how is this avoided?

(4 marks)

END OF EXAMINATION

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

SECOND SEMESTER EXAMINATIONS - JANUARY 2004

AGF 542 – PLANT DESIGN

INSTRUCTIONS

1. ANSWER ALL QUESTIONS
 2. OPEN BOOK EXAM. NOTES CAN BE USED BUT NOT EXERCISES OR RESOLVED PROBLEMS.
-

1. A sherry with the following composition:

% (weight) alcohol = 16

% (weight) sugars = 3

should be prepared by combining (blending) three different wines having the following composition:

<i>Wine</i>	<i>% alcohol</i>	<i>% sugars</i>
<i>A</i>	<i>14.6</i>	<i>0.2</i>
<i>B</i>	<i>16.7</i>	<i>1.0</i>
<i>C</i>	<i>17</i>	<i>12.0</i>

Calculate the kg of A, B, C to be mixed for the preparation of 100 kg of sherry.

2. For the controlled atmosphere storage of vegetables a gas mixture with the following composition is needed: 90% N₂, 5% CO₂, 5% O₂. Calculate the amount of air, CO₂ and N₂ needed to prepare 100 m³ of the mixture.

3. In the manufacture of jam, 45 parts of squeezed fruit, 55 parts of sugars (and some pectin) are mixed. Then, the mixture is concentrated by evaporation to obtain a mixture containing 67% of soluble solids (sugars and soluble materials of fruit). Calculate i) the yield in jam when a fruit containing 14% of soluble solids is used. ii) the amount of water to be removed to obtain the final product.

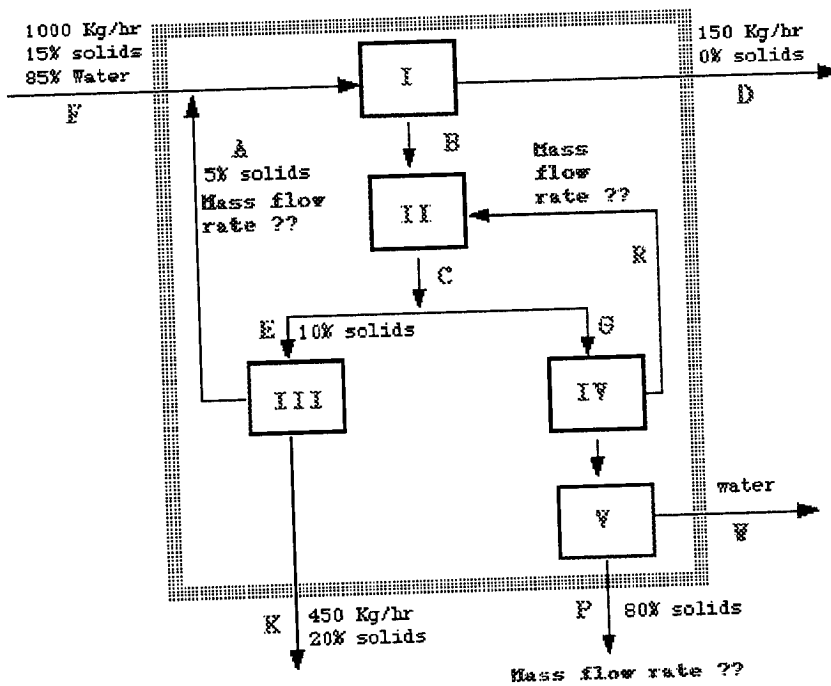
4. The preparation of a food is accomplished by means of 5 different stages (see figure). If the feeding stream is 1000 Kg/hr of raw food, calculate

a) kg/hr of final product (P)

b) kg/hr of recycle A

c) kg/hr of recycle R

Please notes that stream C is splitted in two equal streams (E and G).



5. An orange juice is prepared as follows

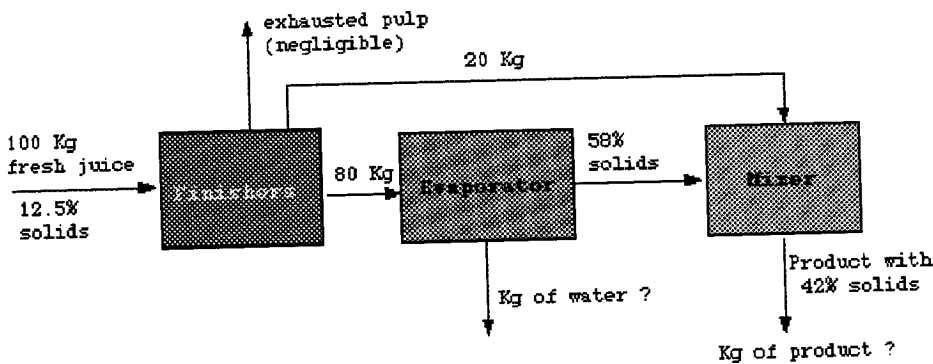
The fresh juice (100 kg, 12.5% solids) is forwarded to a finisher where exhausted pulp is removed. This stream may be assumed to be negligible.

- The resulting juice is split in two stream with different content in solids.

- The first stream 80% of the finisher feeding is send to the evaporator where it is concentrated up to 58% solids.

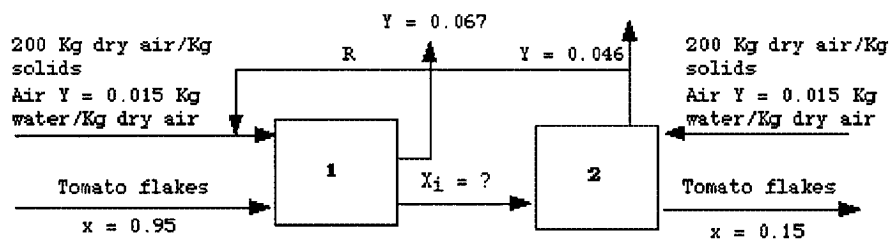
- The second stream (20%) is used to dilute the concentrated juice (58% solids) to obatin a final product having a concentration of 42% solids.

Calculate the amount of water to be evaporated, the amount of the final product and the solid concentration in each stream leaving the finisher. Eventually, a reason for which the juice is not directly concentrated to 42% solids should be suggested.



6. Tomato flakes (moisture content on wet basis = 0.95) should be dehydrated, with air in a two stages drier, up to 0.15% humidity (wet basis). In the first stage air and tomatoes flows are parallel and countercurrent in the second stage. Part of the air leaving the second effect is mixed with the air entering the first stage. The process is accomplished with a stream of air (200 kg dry air / Kg solids) containing 0.015 Kg water/kg dry water. Calculate the amount of dry air recycled and the moisture content of tomatoes leaving the first stage.

Please note that Y and X indicates humidity of air and tomatoes, on dry base, respectively. Humidity on wet base is indicated with lower case letters (x and y).



-----End of Exam-----

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

2002/2003 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS

AGS 222: FUNDAMENTALS OF SOIL SCIENCE

TIME: THREE HOURS
MARKS: 100
INSTRUCTIONS: ANSWER ALL QUESTIONS

1. Soil A was monocropped with maize for three years while soil B was left under grass fallow for the same period. Soil samples from both treatments were dry and wet sieved, giving the following data.

Diameter of Aggregate mm	Average diameter mm		Aggregate % after dry sieving		Aggregate % after wet sieving	
	Soil A	Soil B	Soil A	Soil B	Soil A	Soil B
8-5	8.0	6.5	18	20	10	15
5-3	6.0	4.0	42	40	23	18
3-2	4.0	2.5	20	15	37	20
2-0	5.0	1.0	20	25	30	47

- (a) Determine in which treatment soil aggregation was enhanced? (10 marks)
- (b) Describe the conditions under which you would expect the formation of the following soil structures: (8 marks)
- (i) crumb
 - (ii) columnar
 - (iii) massive
 - (iv) platy
2. List four major chemical and four major physical limitations to root growth in soil. Describe how each of these limitations may be diagnosed. (16 marks)
- 3 (a) A 5 t ha^{-1} crop of maize transpired 3.2×10^9 g of water per growing season. Given that the average P concentration in the soil solution during the season was 0.1 mg kg^{-1} , and sufficient P content in plant tissue is 0.2%, would mass flow supply adequate P to meet the plant requirement? (5 marks)
- (b) Describe what is meant by phosphate fixation and distinguish it from potassium fixation in soil. (6 marks)

4. An acid soil was titrated in the laboratory by adding increasing amounts of $\text{Ca}(\text{OH})_2$ to 10g samples. After 7 days of incubation the pH of the soil was measured and the following results were obtained:

Vol. of 0.027 N $\text{Ca}(\text{OH})_2$ added (cm^3)	Measured pH
0	4.80
10	6.00
20	6.60
30	7.10
40	7.55

- (a) From the titration curve, calculate how much of pure $\text{Ca}(\text{OH})_2$ (kg/ha) per ha is required to raise the pH to 6.5, assuming that the mass of soil to a depth of 15 cm is 2600 tons per ha. (15 marks)
- (b) How much of 75% pure CaCO_3 would be required? (5 marks)
5. Why do crop plants produce yields less than their potential on strongly acid soils? (7 marks)
6. (a) Describe the components of the total water potential and demonstrate how they influence water movement in soil. (5 marks)
- (b) Discuss the reasons for the poor correlation often found between soil tests for available nutrients and observed crop performance in the field. (5 marks)
7. Given that the basic ions were extracted by neutral 1M NH_4Aoc and acid ions by 1M KCl from a 50 g soil sample giving the following values:

$\text{Ca}^{++} = 36 \text{ mg}$	$\text{Na}^+ = 11 \text{ mg}$
$\text{Mg}^{++} = 30 \text{ mg}$	$\text{Zn}^{2+} = 15 \text{ mg (mw = 56)}$
$\text{Al}^{3+} = 35 \text{ mg}$	$\text{Cu}^{2+} = 15 \text{ mg (mw = 64)}$
$\text{H}^+ = 28 \text{ mg}$	$\text{Mn}^{2+} = 3 \text{ mg (mw = 55)}$
$\text{K}^+ = 15 \text{ mg}$	$\text{Pb}^{2+} = 3 \text{ mg (mw 207)}$

Calculate

- (a) The Effective Cation Exchange Capacity (ECEC) (10 marks)
- (b) The % Base saturation (BS) and acid saturation (5 marks)
- (c) Comment on the suitability of this soil for plant growth (3 marks)

END OF EXAM

UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS
JANUARY 2004

AGS 322: SOIL PHYSICS

Time: Three (3) Hours

Marks: 80

Instruction: Answer all Questions

1. Briefly define each of the following terms: [10 marks]

- a) Rill erosion
- b) hysteresis
- c) Basic infiltration
- d) Sorptivity
- e) Air capacity of the soil

2. With a sketch, describe the different zones that can be identified during a vertical infiltration on a homogeneous soil profile with uniform initial moisture content. [10 marks]

3. Water flow in a soil media can be described by the following equation in its partial differential form is expressed as: [15 marks]

$$\frac{\partial \theta}{\partial t} = K_x \cdot \frac{\partial^2 H}{\partial x^2} + K_y \cdot \frac{\partial^2 H}{\partial y^2} + K_z \cdot \frac{\partial^2 H}{\partial z^2}$$

- a) Explain the different components in the equation above
 - b) Derive from the above equation, an equation describing:
 - i) Saturated flow under anisotropic conditions
 - ii) Unsaturated flow under isotropic conditions
 - iii) Horizontal flow under unsaturated conditions
4. An overhead (pivot) irrigation system under winter maize was set based on the following measured field data: [20 marks]

Depth (cm)	Bulk Density (g cm ⁻³)	Soil Water Content on Weight Basis (%)	
		Field Capacity	Wilting Point
0 – 15	1.55	20.1	12.8
15 – 30	1.54	21.3	12.9
30 - 60	1.62	20.5	13.3
60 - 90	1.63	20.7	13.1
90 - 120	1.62	19.8	11.4

- a) Determine the available water-holding capacity (AWC) of the soil profile to a depth of 1 meter (**mm**)
- b) How deep (in **meters**) would a 40 mm irrigation infiltrate the soil if the soil water content is maintained at field capacity and assuming that the water content in the profile is at wilting point

- c) The crop evapotranspiration was 12 mm day^{-1} during grain-filling stage with maximum rooting zone of 100cm, how often (*time interval in days*) should the crop be irrigated if a depletion of only 50% of AWC is allowed before the next irrigation
- d) What measures would you take in order to increase the available water-holding capacity of this soil
5. A new investor in Chiawa acquired a 200 hectare farm in the lower Zambezi valley near the confluence of the Kafue and Zambezi Rivers. On one site where the farmer planned to set up a green house, the following soil properties were measured from a representative soil profile pit [25 marks]

Soil Depth (m)	Temperature (°C)		Bulk Density (Mg m ⁻³)	Soil water content (g/g)
	05:00hr	14:00hr		
0.00 – 0.05	15	35	1.50	0.050
0.05 - 0.20	20	30	1.50	0.100
0.20 – 0.60	18	25	1.54	0.130
0.60 – 1.20	17	18	1.53	0.132

- a) What is the direction of heat flow at 05:00hr and 14:00hr
- b) Calculate the amount of water stored in the soil profile ($\text{m}^3 \text{ ha}^{-1}$)
- c) Calculate the heat capacity of the soil profile on volumetric basis ($\text{MJ m}^{-3} \text{ }^\circ\text{C}^{-1}$)
- d) Calculate the quantity of heat (Q_q) stored in the soil per unit area for the period from 5 to 14 hrs (MJ m^{-2})
- e) How would you maintain the optimal soil temperature for plant growth

End of Exam

UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS
JANUARY 2004

AGS 331: SOIL SURVEY TECHNIQUES

TIME: 3 HOURS

MARKS: 60

INSTRUCTIONS: ANSWER ALL QUESTIONS

1.
 - a. From your understanding of the Zambian Land Capability Classification System, what would suggest as its main weaknesses?
(5 marks)
 - b. What would you understand by the following Land Capability Classes?
(i) C1d (ii) S4w (iii) Gw (iv) S3de (v) Ur
(5 marks)
2.
 - a. Explain the importance of scale, remote sensing and ground truthing in each of the following soil survey levels.
(i) Exploratory (ii) Semi-Detailed (iii) very detailed
(6 marks)
 - b. How has each of the soil survey levels in Question 2a been used in Zambia?
(4 marks)
3. A prospective farmer wishes to purchase a piece of land where he intends to produce irrigated wheat, rainfed maize, and improved pastures. He is, however, not sure whether he needs a soil survey to be carried out on this piece of land. He then approaches for advice.
 - a. Convince him that it will be to his benefit to have a soil survey of the area.
(5 marks)
 - b. Eventually you manage to convince him but he asks you to carry out the survey. Briefly outline the steps you would take to accomplish this assignment.
(5 marks)

4. During a quality control exercise, topsoil clay content was measured at 10 randomly selected points in one soil unit. The following results were obtained:

<u>Point</u>	<u>% topsoil clay content</u>
1	15
2	20
3	12
4	17
5	23
6	9
7	11
8	17
9	16
10	15

Given that the maximum permissible variability is 2%, comment on the reliability of this mapping exercise. (10 marks)

5. a. Soil surveys may be general- or special-purpose. How different from each other are these soil survey types? (5 marks)
- b. How are airphotos used in soil surveys? (5 marks)
6. Suggest how soil survey information would be used in the following fields:
- a. irrigated farming
 - b. pest control
 - c. fish farming
 - d. taxation

(10 marks)

END OF EXAMINATION

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

2002/2003 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS

AGS 422: SOIL MICROBIOLOGY

TIME: THREE HOURS
MARKS: 60
INSTRUCTIONS: ANSWER ALL QUESTIONS

1. It is desired to optimize the utilization of fertilizer $-N$ on a maize crop requiring 300 kg N ha^{-1} per season. Given that a soil contains 2.5% organic matter to a depth of 20 cm, bulk density of 1.4 g cm^{-3} and a C/N ratio of 10,
- (a) Calculate the amount of mineral N released during the growing season in Zambia. Assume the mineralization rate of 6% per annum.
(5 marks)
- (b) If the efficiency of utilization of this mineral N is only 50%, how much more N should still be applied to meet the plant requirement?
(5 marks)
2. (a) Dissolved organic matter reacts with dissolved O_2 in water. Calculate the amount of O_2 that would be consumed by 16.4 mg of polymeric carbohydrate (CH_2O).
(6 marks)
- (b) What is meant by the term “thermal pollution” when applied to warm waters in lakes and rivers?
(2 marks)
- (c) What is eutrophication or algal bloom and how can it be controlled?
(5 marks)
3. A soil was treated with various materials, each supplying 600 mg N before being incubated. At the end of 3 months of incubation the NO_3^- was determined. Interpret the following data:
(10 marks)

Organic Amendment	N Content of Substrate %	NO_3^- in soil after 3 months. (mg)
Untreated soil	-	946.6
Dried blood	10.71	1751.1
Clover roots	1.71	924.4
Maize roots	0.79	510.6
Timothy grass roots	0.62	398.4
Oat roots	0.45	207.3

4. Describe specific conditions under which Versicular Arbuscular Mycorrhizal (VAM) symbiosis with plant would be most beneficial agronomically. (10 marks)
5. (a) What are the advantages of composting organic wastes as opposed to their direct application to soils? (5 marks)
- (b) Nitrification is often described as a “mixed blessing” in agronomy. What does this mean? (5 marks)
6. (a) Describe the mechanism by which chlorine disinfects water. (3 marks)
- (b) What is the BOD ($\text{mg O}_2 \text{ dm}^{-3}$) of sample if a 25 cm^3 aliquot of a water sample is titrated with 6.3 cm^3 of $0.0015 \text{ M Na}_2\text{Cr}_2\text{O}_7$? (4 marks)

END OF EXAM

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS
JANUARY 2004

AGS 452 PRINCIPLES OF LAND HUSBANDRY

TIME: 3 HOURS

MARKS: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. Define the following terms:
 - a) contour tillage (2 Marks)
 - b) controlled burning (2 Marks)
 - c) land terracing (2 Marks)
 - d) shifting grazing (2 Marks)
 - e) recommendation domains (2 Marks)
2.
 - a) List five (5) reasons for characterizing land. (5 Marks)
 - b) Discuss the different levels of soil survey intensities. (10 Marks)
3.
 - a) What is land degradation? (2 Marks)
 - b) What are the four (4) different ways in which you may alter land-related constraints? (8 Marks)
4.
 - a) List ways in which loss of voids in the soil volume come about. (6 Marks)
 - b) Discuss the reasons why loss of soil voids is as important as, and even more important than, loss of soil particles. (4 Marks)
5.
 - a) What is the purpose of data collection? (2 Marks)
 - b) Distinguish between qualitative and quantitative data collection. (2 Marks)
 - c) Distinguish between background secondary information and primary information. (2 Marks)
 - d) What is the difference between formal and informal surveys? (2 Marks)
6.
 - a) What are the characteristics of a resource-poor rural farmer (household)? (10 Marks)
 - b) What is the type of problems faced by most small scale farmers? (10 Marks)
7. Which are the two (2) steps involved in the soil erosion processes? (4 Marks)

8. Who are the ultimate decision makers on what should happen on the land, and mention five (5) factors which influence their decisions? (12 Marks)
9. What is the social significance of livestock in a rural farming community? (6 Marks)
10. a) Discuss briefly two (2) important points to consider in the management of rangelands. (2 Marks)
- b) Burning may successfully be used as a management tool at individual level but at communal level it can only be used successfully if three (3) requirements are met. List these requirements. (3 Marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS
JANUARY 2004

AGS 522: SOIL AND PLANT ANALYSIS

TIME: 3 HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

Marks: 100

1. Given a stock solution that is 5N HCl show the calculation for and explain how you would prepare a 0.01N HCl solution in the laboratory. (10 marks).
2. Give a step by step description of N analysis using the Kjeldahl procedure. What is the role of NaOH and why is it important not to omit it? If there is interest to separate NH_4^+ and NO_3^- what must be done? (10 marks).
3. It is generally recognized that when soil analysis is done, the objective may be to detect one or more of the various soil nutrient pools. Discuss these pools with respect to an element of your choice and give your understanding of their relative availability to plants. (10 marks).
4. In order to determine the calcium content of a lime sample, 5g material was weighed, digested and diluted to 100 ml. Out of this, 10 ml aliquot was removed and diluted to 200 ml mark in a volumetric flask. Upon reading the sample on the AAS, a reading of 30 mg Ca L^{-1} was obtained. Calculate and express the calcium in the sample on a percent basis. (10 marks).
5. A student was given instructions to harvest dry matter from a maize experiment. The samples were to be analyzed for all essential elements. She proceeds to cut the plants and lay them on the ground, on a windy day. Using your knowledge of plant sample preparation, how would you advise her to go about her task and what are the potential challenges from harvest to final result? (10 marks)
- 6a. What is the difference between active and reserve acidity? (2 marks)
- b. How is each portion of acidity measured, and what are the potential problems with these procedures? (5 marks).
- c. How does each portion of soil acidity affect lime requirement? (3marks)

7. Given the following soil test results, indicate your interpretation of the data and where you would make fertilizer recommendations for general field crops. (10 marks).

Element	Test level	Interpretation	Apply fertilizer? (Yes or No)
pH	5.2		
N	0.2 %		
P	8 mg kg ⁻¹		
K	90 mg kg ⁻¹		
Ca	100 mg kg ⁻¹		
Mg	40 mg kg ⁻¹		
S	5 mg kg ⁻¹		
Mn	20 mg kg ⁻¹		
Zn	4 mg kg ⁻¹		
Fe	10 mg kg ⁻¹		
Cu	5 mg kg ⁻¹		
B	0.2 mg kg ⁻¹		

8. Diagnostic patterns that are observed on plants, such as chlorosis, bronzing and dwarfing are not always due to nutrient deficiencies. What else causes these patterns that one needs to be aware of and watch for in the field? (5 marks)
9. The nutrient concentration levels in plant tissue may vary with plant age. What pattern would you expect for phosphorus and potassium throughout the normal life cycle of a plant? Why is there a change in these concentration levels? (10 marks).
10. If a foliar analysis result shows the information below, discuss the nutrient concentration levels for crops in general and suggest the symptoms that may be visible on the plants. Try to limit the symptoms using the concept of most limiting nutrient. (10 marks)

N- 1.2 %
 P- 0.5 %
 K- 3.5 %
 Ca- 0.1 %
 Mg- 0.4 %
 Mn- 200 mg kg⁻¹
 Zn- 25 mg kg⁻¹
 Fe- 80 mg kg⁻¹
 B- 5 mg kg⁻¹

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
UNIVERSITY SECOND SEMESTER EXAMINATION

AGS 542: SOIL CLASSIFICATION

TIME: 3 HOURS

MARKS: 70

INSTRUCTIONS: ANSWER ALL QUESTIONS

1. Using a diagram, describe the parent material cycle (6 Marks)

2. a) List the basic properties of a soil whose name is :
Clayey, kaolinitic, deep acid isohyperthermic Typic Rhodustalf (2 Marks)
b) Comment on the limitations and potentials of this soil (5Marks)

3. Describe briefly with two examples of each, three types of hard rocks which are a source of soil parent material (9 Marks)

4. Mention five factors retarding soil development (5 Marks)

5. With the aid of a diagram, briefly explain the concept of a soil catena (8 Marks)

6. Explain the soil factors which have contributed significantly to soil differentiation in Zambia's
a) Region I and b) Region III (8 Marks)

7. Explain the relationship between rainfall and the following soil properties/pedogenic processes (9 Marks)
 - a). Clay content of a soil profile
 - b). Soil erosion
 - c). Chemical fertility

8. You have been contracted to do a baseline survey for an agricultural project. You have just finished your work and part of your findings are outlined in the field worksheet shown in annex 1.

- a) From your field worksheet, outline a standard soil profile description. (4 Marks)
- b) Using your soil profile description and the analytical data provided in annex 2, make an inventory of the diagnostic surface and subsurface horizons using the USDA method of soil classification. (4 Marks)
- c) Classify the soil up to family level using the USDA method. (5 Marks)
- d) Comment on the limitations and potentials of this soil (5 Marks)

ANNEX 1

FIELD WORKSHEET

Soil Observation description form

Profile no. AGS 1

Survey area: Lusaka west

Author(s): 2003 AGS 542

Map sheet no. : 297/4

Date: 12/01/04

Coordinates: 28° & 29° E/15° 42' & 16° S

Parent material: Granite/Quartzite

Land Form: Fairly rocky with pockets of soil

Slope gradient: 2%

Elevation: 1000m

STR: Isohyperthermic

SMR: Ustic

Nat. drainage class: Well

Flooding/Ponding: Very rare

Erosion: Splash

Degree: Slight

Rock out crops: 60%

Land use: Quarrying and patches of crop production

Vegetation/crops: Brachystegia (Miombo), Acacia (Muunga), maize

PROFILE CHARACTERISTICS

HORIZON			COLOUR		TEXTURE/ COARSE FRAGMENTS	STRUCTURE	
designation	Profile sketch	Depth(cm)	Dry/moist	description		size	form
Ah		20	7.5YR4/2 7.5Y3/4	Dark brown Dark brown	SCL SCL	Medium	Sub angular blocky
Bw		60	7.5Y4/4	Brown to dark brown	SCL	Medium to coarse	Sub angular blocky.

ANNEX 2

ANALYTICAL DATA FOR PROFILE AGS1

HORIZON	Ah	Bw
Depth (cm)	0– 20	20 – 60
Clay (%)	25	24
Silt (%)	13	11
Very fine sand (%)	12	13
Fine sand (%)	30	33
Medium sand (%)	15	15
Coarse sand (%)	3	3
Very coarse (%)	2	1
Texture class	SCL	SCL
pH H ₂ O 1:2.5	4.4	4.4
pH KCl 1:2.5	3.9	4.0
Ec mS/cm1:2.5	0.04	0.02
Organic C (%)	2.3	1.3
Total N (%)	0.16	0.10
C/N	14	13
Available P (mg/kg)	2	3
CEC NHOAC cmol/kg	13.4	13.7
Exch. Ca cmol/kg	1.6	1.4
Exch. Mg cmol/kg	2.3	2.6
Exch. K cmol/kg	0.06	0.02
Exch. Na cmol/kg	0.03	0.02
Exch. Al cmol/kg	1.2	0.9
Base saturation %	7	29
CECclay cmol/kg	54	57