

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCE
SECOND SEMESTER EXAMINATION 2009

1. AGA 222 PHYSIOLOGY OF DOMESTIC ANIMALS
2. AGA 322 RUMINANT PRODUCTION (BEEF, DIARY,SHEEP,GOATS
& RABBITS
3. AGA 332 APPLIED ANIMAL NUTRITION
4. AGC 312 CROP PROTECTION
5. AGC 322 FORAGE CROP PRODUCTION
6. AGC 332 CROP PROTECTION
7. AGC 342 PRINCIPLE OF CROP PRODUCTION
8. AGC 422 HORTICULTURE SCIENCE 1
9. AGC 442 PLANT BREEDING 1
10. AGC 572 POST HARVEST TECHNOLOGY
11. AGE 222 FUNDAMENTAL OF MACROECONOMICS
12. AGE 442 AGRIBUSINESS STATISTICS AND DATA ANALYSIS
13. AGE 562 FARM MANAGEMENT
14. AGE 582 PROJECT MONITORING AND EVALUATION
15. AGS 222 FUNDAMENTALS OF SOIL SCIENCE
16. AGS 422 SOIL MICROBIOLOGY

SHORT LOAN COLLECTION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2009/2010 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGA 222
PHYSIOLOGY OF DOMESTIC ANIMALS

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:

- 1) ANSWER ALL QUESTIONS IN BOTH SECTIONS**
 - 2) WRITE EACH SECTION IN SEPARATE ANSWER BOOKS**
 - 3) ALL QUESTIONS**
-

SECTION A

Q1. [30 POINTS]

The intrinsic ability of cardiac muscle to generate action potentials (APs) rhythmically is achieved by the normal pace-maker, the sino-atrial node (S-A node). The S-A node is part of the special excitatory and conductive system of cardiac muscle. With the help of a diagram, describe this conductive system and how the AP spreads throughout the muscle.

Q2. [20 POINTS]

- a) Briefly describe the conduction of an action potential in a visceral smooth muscle tissue.
- b) Action potentials of visceral smooth muscle occur in two different forms. Describe them.

Q3. [20 POINTS]

- a) Despite being lipogenic, the absence of insulin in an animal's body causes a fatty liver. Describe how this is possible.
- b) In the order of importance, the first two most important factors that play a role in the regulation of aldosterone secretion by the adrenal cortex are (1) K^+ ion concentration of the ECF and (2) Renin-angiotensin system. Describe how these factors play this role.

Q4. [30 POINTS]

Your favourite high-yielding dairy cow is suddenly disturbed by some moving objects and strange noises in the barn during the morning milking. She quickly jumps out of the barn in an attempt to escape from the apparent disturbing environment. You follow her and after a few words of choice, she comes back. You are expecting her to yield some 30 kg of milk but after full time of milking, you manage to squeeze out only 4 kg.

Explain the physiological reasons for this low milk let-down, describing the neural pathways and hormonal responses.

SECTION B

Q5 (15 POINTS)

Respiration involves ventilation and gas exchange. This process is under strict control.

- What is Tidal Volume?
- With aid of a diagram, describe the respiratory control centers? How do they control respiration?
- Briefly describe oxygen transport and the haemoglobin dissociation curve??
- If a goat starts running, how will breathing be affected?

Q 6 (40 POINTS)

Reproduction ensures perpetuity of species and increase in farm animal numbers. Knowledge of reproductive processes has enabled animal scientists to manipulate the processes to improve and advance farm animal productivity.

- When is a cow said to be ready for reproductive functions?
- What characteristics and behavioural signs indicate that a Sow is ready for mating?
- What is spermiogenesis?
- Describe the fertilization process? Why is it that generally only one sperm fertilises the ova?
- What maintains pregnancy in sheep? How does it maintain pregnancy?
- What initiates parturition?
- What is Colostrum and why is it important?
- With aid of a diagram, define a lactation curve? Can it be altered?
- What factors affect galactopoesis?

Q7. (30 POINTS)

Digestion is an essential process of all living animals.

- Adult cattle produce about 100 to 150 liters of saliva per day. What are the functions of saliva in cattle?
- How is saliva production regulated?
- What is the role of Cholecystokinin (CCK)?
- What is rumination and why is it important?
- Describe the composition and control of production of gastric juice?
- Schematically depict transport of nutrients from the gastro-intestinal tract

Q8. (15 POINTS)

The body's characteristic is to keep the body core temperature constant.

- Define comfort zone?
- How is body core temperature controlled?
- What actions and reactions take place when a lactating cow is under extreme hot environment?

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END OF EXAMINATION

Thank you for being with us in the course. We wish you Good Luck.

Dr. Jeyaraj

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THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2009 Academic Year – Second Semester Final Examinations

Course AGA 322 – Ruminant Production (Beef, Dairy, Sheep, Goats and Rabbits)

Time Allowed: Three (3) Hours Only

Instructions to Candidates:

- a. All Questions carry equal marks (20).
 - b. Answer any five (5) questions, **at least one from each section.**
 - c. Use separate answer book-lets for each Section.
-

SECTION A – BEEF PRODUCTION:

- Q. 1 It is not advisable to import breeds of beef cattle from temperate countries when it is possible to provide adequate feed and the ideal grazing conditions at least similar to those obtained from their countries of origin. In Zambia the indigenous beef cattle breeds such as the Angoni, the Tonga, the Baila and the Barotse have many good characteristics which enable them to do well in this country.
- a) Outline their good characteristics that enable the indigenous breeds of beef cattle to perform well under the local conditions.
 - b) How can the performance of the indigenous beef cattle breeds on Zambia be improved.
- Q. 2 Outline and explain all the routine management practices that should be carried in a beef herd of your choice in order to ensure good performance.

SECTION B – DAIRY PRODUCTION:

- Q. 3 Calf rearing is an important aspect of dairy farming as the saying goes, 'a calf of today is the cow of tomorrow'. Explain how you would go about in managing a calf from birth to weaning. What are the key factors to successful calf rearing?
- Q. 4 Explain the steps you would take in maintaining clean and sanitary conditions on the farm of your choice for the production of high quality milk that is free of physical, chemical and microbial contaminations.

SECTION C – SHEEP AND GOAT PRODUCTION:

- Q. 5 In Zambia, especially in the Southern Province, sheep and goats have been described as the poor man's cattle:

- a. What are the factors that should be taken into consideration in the process of selecting of the ram and the buck as breeding stock?
 - b. Write notes on the use of the twice-a-year breeding season in sheep and goat production.
- Q. 6 Having been recently appointed as the Farm Manager of an intensive sheep and goat enterprise at UNZA's Liempe Farm, discuss any ten (10) lamb and kid routine management practices that you would put in place to ensure that the farm operates profitably.

SECTION D – RABBIT PRODUCTION:

- Q. 7 The rabbit meat has been described as tasty, of good quality and highly nutritious just like chicken meat. As a result rabbit meat is now eaten in most countries of the world. In addition, rabbits are small and very cheap to purchase and to house, therefore, the initial capital outlay is minimal; and with some scrap wood or bamboo a rabbit hutch can easily be constructed. Prepare notes on any other ten (10) reasons of raising rabbits in preference to other types of livestock in any district of Zambia of your choice.
- Q. 8 A good rabbit breeding routine is also good management. Discuss the factors that may limit conception or result in low conception rates in a rabbit unit of your choice.

END OF EXAMINATION

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2009/10 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATIONS**

AGA 332: APPLIED ANIMAL NUTRITION

TIME : THREE (3) HOURS
INSTRUCTION : ATTEMPT ALL THE QUESTIONS

1. Explain how exposure to rain can reduce the feeding value of a harvested roughage giving examples of two materials susceptible to such damage.
(10 marks)
2. Locally available roots and tubers may not offer very good nutrition in non-ruminants owing to some features associated with these materials. Identify and briefly discuss the features.
(10 marks)
3. Briefly discuss soybean meal as an ingredient in animal feeds.
(10 marks)
4. In spite of being a good protein source, fish meal is rarely used in Zambian stockfeeds, and when used, may be used in restricted amounts. What in your opinion could be the main factors contributing to this state of affairs? Discuss briefly.
(10 marks)
5. Briefly describe the following as feed ingredients:
 - a. Single-cell protein.
 - b. Poultry manure.(10 marks)
6. Calculate the following:
 - a. Proportions of maize bran and sunflower meal in a 15% crude protein feed supplement mixture that has 0.5% salt, 2% limestone and 1% dicalcium phosphate, if maize bran has 9.5% crude protein and sunflower meal has 28% crude protein.
 - b. Amount of cotton seed meal (in kilograms) required to make up for the short-fall in TDN for a cow requiring 4kg TDN/day and supplied 8 kg hay/day containing 35% TDN, if cotton seed meal has 48% TDN.

- c. Amount of a vitamin A source required in 5,000kg of feed for the requirement of 2,200IU vitamin A/kg feed, if the concentration of vitamin A in the source is 500,000IU/g.
- d. Amount of a biotin source required in 8,000kg feed for the requirement of 1mg biotin/kg feed, if the concentration of biotin in the source is 15,000mg/kg.
- e. Amount of ferrous sulphate required in 6,000kg feed for the requirement of 140mg Fe/kg feed, if ferrous sulphate has 33% Fe.
(25 marks)

7. Ms Jones has a broiler farm and intends to make her own feed for her broilers. She wants her feed to supply 3,200 kcal/kg ME, 20% crude protein, 1.00% lysine, 0.38% methionine, 0.90% calcium and 0.75% phosphorus.

She has the following ingredients with indicated nutrient composition:

<u>Ingredient</u>	<u>MEkcal/kg</u>	<u>CP%</u>	<u>Lysine%</u>	<u>Methionine%</u>	<u>Ca%</u>	<u>P%</u>
Maize meal	3,300	8.5	0.24	0.20	0.20	0.28
Sorghum meal	2,800	11	0.25	0.22	0.20	0.25
Soybean meal	2,500	42	2.80	0.60	0.25	0.60
Oil	8,000	-	-	-	-	-
Limestone	-	-	-	-	38	-
Dical. Phosph.	-	-	-	-	22	18
Methionine	-	-	-	98	-	-
Lysine	-	-	89	-	-	-
Salt	-	-	-	-	-	-
Premix *	-	-	-	-	-	-

*The premix was formulated for inclusion in the feed at a rate of 1%.

Provide Ms Jones the following:

- a. A feed formula that makes use of the two grains and soybean meal as main ingredients.
- b. A guide to ingredient quantities appropriate for her 2,000kg feed mixer based on your formula.

(25 marks)

END OF EXAMINATION QUESTIONS



The University of Zambia

School of Agricultural Sciences

Department of Plant Science

Second Year Examinations for the Degree of Bachelor of Agricultural Sciences

AGC 222: Introduction to Farming Systems

Second Semester, 2010

Date: 21 April, 2010

Time: 09.00 – 12.00hrs

Instructions

- 1. Answer all questions**
- 2. Marks as indicated**

- Q1.** a. Explain the social factors affecting farming decisions at farm level (6)
b. Explain the economic factors affecting farming decisions at farm level (6)
- Q2.** Explain the advantages and disadvantages of using the following experimental designs in agricultural research:
a. Completely Randomized Design (4)
b. Randomized Complete Block Design (4)
c. Split Plot Design (4)
- Q3.** a. Explain situations when the following types of experiments are used in FSR
i. Type 1 experiment (2)
ii. Type 2 experiment (2)
iii. Type 3 experiment (2)
b. State the objectives for each of the experimental types listed in Q3a above (6)
- Q4.** a. What are the advantages of using Participatory Rural Appraisal (PRA) in carrying out surveys in FSR (4.5)
b. Explain the techniques that can be used to carry-out a PRA (7.5)
- Q5.** Suppose you are an Agronomist in the Ministry of Agriculture and Cooperatives based at Kazungula district in the Southern province of Zambia, what advice would you give to a farmer intending to grow a successful maize crop? (12)

END OF EXAMINATION



UNIVERSITY OF ZAMBIA
School of Agricultural Sciences

AGC312: CROP PROTECTION

SECOND SEMESTER 2010

DATE: Thursday 29th April 2010

TIME: 14:00 – 17:00 hours

VENUE: UPPER DH

INSTRUCTIONS

The examination is made up of three sections, A, B and C. Each section has got further instructions accompanying it. Follow them. Use a separate answer booklet for each section.

SECTION A: PLANT PATHOLOGY

Choose any two questions each of which carries 15 points

(15 points)

- 1) What are the advantages and disadvantages of chemical control measures in the management of major crop diseases?
- 2) What is the importance of disease forecasting? Describe the four common methods used in disease forecasting.

(15 points)

A disease triangle is the central concept of plant pathology; Briefly discuss the elements of the triangle.

What are non-infectious diseases and how are they managed?

What are the genomic and biological properties of viruses?

3 (15 points)

- a) What are the factors accounting for the success of plant fungal pathogens, the common symptoms of plant fungal diseases and the methods of spread of phytopathogenic plant fungal diseases?
- b) How would a farmer avoid the development of resistant strains of plant pathogens when using fungicides to control plant diseases?

SECTION B: WEED SCIENCE

Answer one question. Each question carries 15 points.

(15 points)

How are weeds different from other plant pests and why are they the most underestimated pest of tropical agriculture?

(15 points)

What are the major crop-weed interactions of importance to a weed scientist. Briefly describe each of them with specific examples.

SECTION C: ENTOMOLOGY

Answer one question. Each question carries 15 points

(15 points)

Insects are known to be the most diverse organisms on earth in terms of morphology and ecological adaptations. Substantiate the above statement by:

- a) Describing the various types of antennae found among insects; and
- b) Discussing the ecological, economic, medical and veterinary importance of insects.

(15 points)

Explain how various aspects of insect body parts are used to identify insect Orders.

-END OF EXAMINATION-



The University of Zambia

School of Agricultural Sciences

Department of Plant Science

Second Year Examinations for the Degree of Bachelor of Agricultural Sciences

AGC 322: Forage Crop Production

Second Semester, 2010

Date: 22 April, 2010

Time: 09.00 – 12.00hrs

Instruction to Candidates

Answer any five questions.

1. Rangelands have been neglected for a long time in programmes concerning agricultural development although they are very importance as sources of livelihoods for the local people?
 - a). Mention products of economic importance that can be derived from rangelands.
 - b) What are the causes land degradation in these rangelands?
 - c) What management practices should be carried out to conserve the rangelands?

(20 marks)
2. There is normally excess forage for feeding grazing animals during the rain season and serious inadequacy during the dry season.
 - a) What advice would you give to cattle farmers so that they make use of the excess forage during the rain season?
 - b) Browse trees are another important source of feed for ruminants during the dry season. Explain the importance of the browse trees and how they should be managed to ensure improved productivity.

(20 marks)
3. Write short notes on the following (4 points each)
 - a) Selective grazing
 - b) forage antiquality
 - c) short term pastures
 - d) Direct sowing of pastures
 - e) ley farming

(20 marks)
4. Pasture grasses and legumes are an importance component of the ecosystem in grazing lands.
 - a) Mention and explain five botanical differences between pasture grasses and legumes.
 - b) What are the benefits of having grass/legumes mixture in grazinglands compared to pure grass or pure legume stands?

(20 marks)
5. Forage crop breeding is important if the quality of forage crops is to improve to meet the requirements for ruminants. What traits are of economic importance when breeding forage crops and how do they differ from those of field crop breeding.

6. A farmer on Choma decided to go into beef farming. He purchased the following herd of cattle; 3 Tonga bulls, 40 Tonga cows and 20 Angoni Cows. He has 600 hectares of natural grazing land.
- Take 1 livestock unit to 5 hectares**
- a) Define stocking rate
 - b) is this farmer overstocking or understocking his grazing land? Show all calculations to support your answer.
 - c) what would be your advice to this farmer.
- (20 marks)**

Livestock Units of Different Breeds of Cattle

Breed	Cow	Bull	2-3 Years	1-2 Years	0.5-11 Months	0-0.5 Months
Brahman, Simmental	1.5	1.8	1.5	0.8	0.4	0.2
Hereford, Sussex, South Devon	1.3	1.6	1.3	0.7	0.3	0.2
Africander, Boran, Friesian	1.2	1.4	1.2	0.6	0.3	0.2
Barotse, Gurnsey	1.0	1.2	1.0	0.5	0.3	0.1
Tonga, Angoni, Jersey	0.9	1.1	0.9	0.5	0.2	0.1



UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURE SCIENCES
DEPARTMENT OF CROP SCIENCES

Third Year Examinations for Bachelor of Agriculture Sciences

AGC 332: Crop Protection

Second Semester 2009/2010

Date 3rd May 2010

Time 09:00 hrs

Read the instruction carefully

Duration: 3 hours.

Answer all in section A and Choose Any 4 (four) in Section B

Answer both questions,

1.
 - (a) Explain the detection of plant pathogens using molecular tools
 - (b) Explain whether multiple infections by pathogens can occur on one plant.
 - (c) List the non-chemical control measures for managing major crop diseases

[20 marks]
2.
 - (a) Define plant disease epidemic, and describe the devastating effects of two plant diseases that are of historical importance
 - (b) Describe the distinguishing features a sign and a symptom, give examples of each?
 - (c) Explain how the degree of genetic resistance/or susceptibility and uniformity of host might affect the development of epidemics.

[20 marks]

Section B

Answer any four questions.

3. Describe the effects of pathogens on the plant's basic physiological functions.

[15 marks]

4. Write an account on the causal agent, symptoms, disease biology and management of the powdery mildew of cucurbits. [15 marks]
5. Give an outline of the sexual reproduction systems in plant pathogenic fungi. [15 marks]
6. Describe the economic effects and management of post harvest diseases. [15 marks]
7. Discuss the pre-existing and induced structural defenses of plants against pathogens
8. (a) Define host plant disease resistance
(b) Explain the main objectives of breeding for disease resistance
(c) Describe the different types of resistance that may be deployed in a crop variety, give examples where possible. [15 marks]
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END OF EXAMINATION



The University of Zambia

School of Agricultural Sciences

Department of Plant Science

Third Year Examinations for the Degree of Bachelor of Agricultural Sciences

AGC 342: Principles of Crop Production

Second Semester, 2010

Date: 27 April, 2010

Time: 14:00 – 17:00hrs

Instructions

- **(1) Answer all Questions**
 - (2) Marks as indicated**
-

Question 1 (15 Marks)

- a) What factors affect photosynthesis? **(3 Marks)**
- b) When soils with the same water content but having different textures are placed in contact with each other, which way will the water flow? Give reasons for your answer. **(3 Marks)**
- c) What is tissue culture? **(3 Marks)**
- d) Briefly describe 3 functions of phytohormones in plants. **(3 Marks)**
- e) Describe the significance of the phenomenon depicted in Figure 1 on Page 2 in the production of food on earth. **(3 Marks)**

Question 2 (25 marks)

- i) Briefly describe the 2 most comprehensive methods for predicting the effect of climate on evapotranspiration. **(5 Marks)**
- ii) Procedures for selecting crop coefficients are given. What 5 characteristics do crop coefficients take into account? **(5 Marks)**

Given the reference (E_{To}) and crop evapotranspiration (E_{Tcrop}) for Crops 1 and 2:

Crop 1		Crop 2	
E_{To}	=	15 mm	E_{To} = 11 mm
E_{Tcrop}	=	6 mm	E_{Tcrop} = 10 mm

- iii) From your calculation of the crop coefficients, what was the stage of development of the 2 crops? **(15 Marks)**

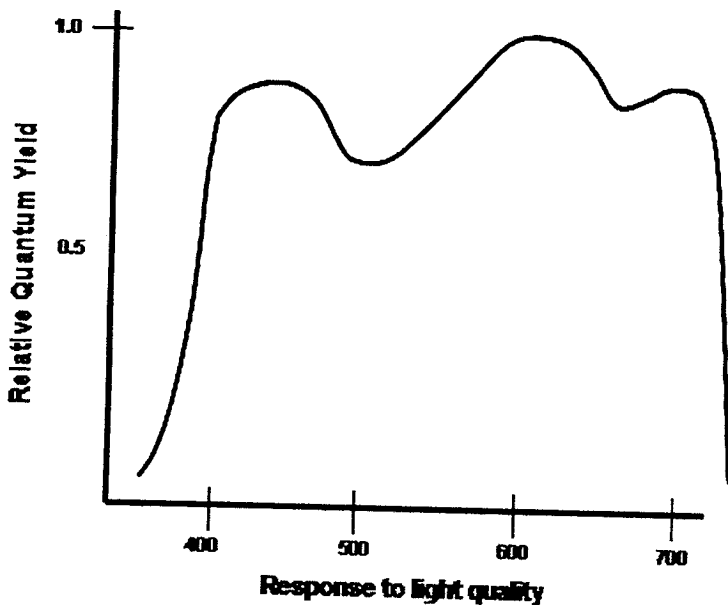


Figure 1: Absorption maxima of chlorophyll pigments

Question 3 (20 Marks)

In 1999 the Government of the Republic of Zambia adopted Conservation Farming Agriculture.

- Describe the basket of technologies in conservation farming. **(7 Marks)**
- Describe the impacts of the technologies in agricultural production. **(6 Marks)**
- How does this farming practice promote the development of an efficient, competitive and sustainable agricultural sector? **(7 Marks)**

Question 4 (20 Marks)

- Describe the main mechanisms for plant nutrient uptake. **(7 Marks)**
- What is:
 - Nutrient buffer capacity? **(3 Marks)**
 - Root absorbing power? **(3 Marks)**
- Describe the phenomenon of plant nutrient uptake depicted in Figure 2 on Page 3. **(4 Marks)**
 - What factors control nutrient uptake? **(3 Marks)**

Question 5 (20 Marks)

The families Fabaceae and Poaceae are important families in the economy of the country.

- Name 2 crops belonging to the family Fabaceae which are grown by small-scale farmers in dry areas of the country. **(2 Marks)**
- Name 3 crops belonging to the family Poaceae. **(2 Marks)**
- What are the scientific names and places of origin of the crops you have selected in i) and ii)? **(4 Marks)**
- Describe at least 3 optimum conditions of growth of the crops you have selected in i) and ii). **(6 Marks)**
- Describe at least 4 uses of economic importance of the crops selected in i) and ii). **(6 Marks)**

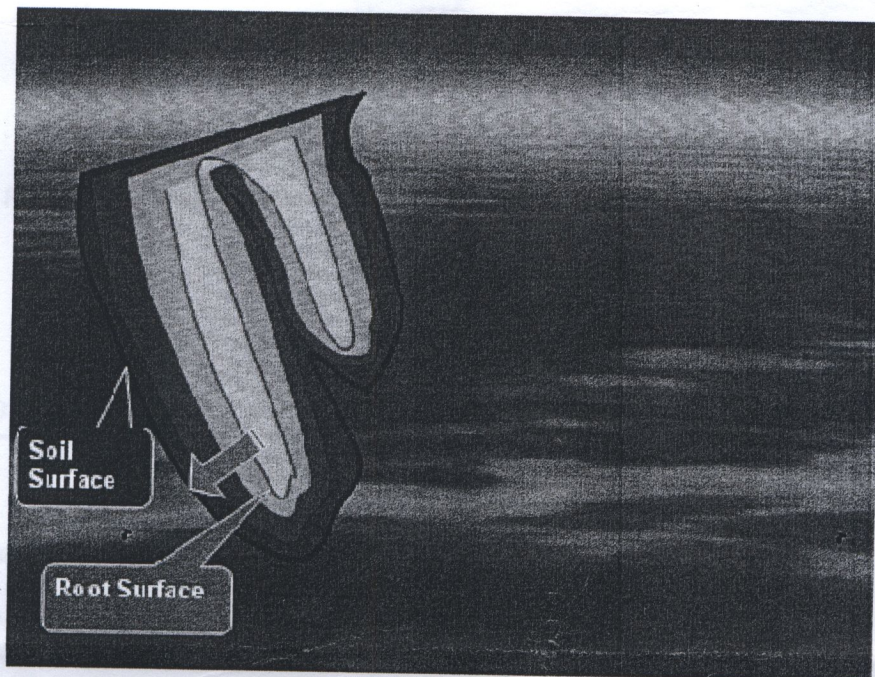


Figure 2

END OF EXAM



UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Fourth Year Final Examinations for Bachelor of Agricultural Sciences

AGC 422 HORTICULTURE SCIENCE 1
Second Semester 2009/2010

Date: 21st April 2010

Time: 14.00 – 17.00 hrs

Instructions

1. Answer all Questions.

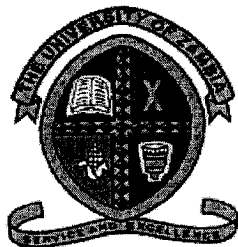
2. Marks for each question are as indicated.

1. A farmer intends to engage in greenhouse production to grow and supply Poiseitnia and Monstera during the Christmas festive season for at least 12 years.
 - a. What are the factors that should be considered before setting up greenhouses?
(15 marks)
 - b. Select suitable covering material that will last as long as the farmer is in production. Give reasons for your selection.
(6 marks)
 - c. List the climatic parameters that need to be considered when growing ornamental plants? How do these parameters affect crop growth? What should be done to ensure good growth of seedling.
(14 marks)
2. i. A farmer intends to grow cabbage, amaranthus and onion for sale. As a newly appointed Agricultural Officer, list varieties (up to 4 where applicable), give the recommended seed rate and spacings for each of the crops.
(13 marks)
- ii. You have been approached by a farmer who has observed the following in her fields:-
 - a. Multiple heads on a cabbage stem.
 - b. White spots on onion plant starting with the tips.

As an Entomologist/Pathologist, identify the pest and/or disease, give other symptoms of disease and/or pest. What would your advice be on preventive or control measures? Your answer should be in table form. **(15 marks)**

- iii. What advice would you give to a farmer relating to when onions and cabbage are ready for harvesting? Your answer should include maturity index for each crop. **(6 marks)**
3. You have been contracted by a farmer to raise/produce pathogen free plantlets of bananas. Choose a suitable method to raise seedlings. Describe the selected method in detail. **(20 marks)**
4. A farmer intends to grow peach seedlings from seed for planting at his farm. Advise the farmer on how he should proceed? **(11 marks)**

END OF EXAM



THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

Fourth Year Examinations for Bachelor of Agricultural Sciences
AGC 442: PLANT BREEDING 1
Second Semester 2009/10

DATE: Tuesday April 20th 2010, PM.

TIME: THREE HOURS

All questions Carry equal Marks. Answer five questions only. However these questions should include the compulsory Question 2.

1.0 Write short notes on the following:

- a) What is a Molecular marker
- b) Physical mutagen
- c) Advantages and disadvantages of Bulk Population Breeding Method
- d) Effect of inbreeding in self and cross pollinated crops.
- e) The Diallel Selective Mating (DSM) Method in Plant Breeding

ANSWER QUESTION 2

2.0 It has been clinically proved that the element Selenium does boost immunity in humans and hence could help in the fight against HIV/AIDS.

Food Technologists have advised the Government to immediately start fortifying maize flour with selenium. However the Government has resolved that this problem will be resolved through Plant Breeding. A Five Member task force of an eminent Plant Breeder, a Soil Scientist, a Nutritionist, a Politician and a representative of a Donor Agency has been set up by Government to initiate and Spear head Research in developing Selenium Heavy Open Pollinated, Synthetic and Hybrid maize varieties as an immune boosting solution to HIV/AIDS Affected people.

Suppose you are the Plant Breeder and Team Leader of the task force.

- a) Clearly illustrate the plan of a comprehensive breeding program that you would propose to the team for developing **selenium rich**

and high yielding Open Pollinated, Synthetic and Hybrid maize Varieties for Zambia.

- b) Suppose the Soil Scientist in the team, has developed a soil selenium map of Zambia for this important Government assignment, how would you use this information for the task at hand?

NOTE: Literature review on selenium uptake in maize indicates that the Nitrate Reductase Enzyme which controls the utilization of Nitrogen by the plant is also responsible for the uptake of selenium through the roots of maize plants and its subsequent translocation to the grain. Maize seedlings showing a high Nitrate Reductase Activity at the three week growing stage indicates a high efficiency of selenium uptake through the roots.

- 3.0 a) Molecular markers have several applications in Agriculture. List and explain the two type of markers and give a detailed account of some of their applications in plant breeding

- b) What is genetic engineering? Explain its relevance and the application of genetic engineering as an additional tool in crop improvement.

4.0. A student in Food Science and Technology is taking an introductory plant breeding course (Because of his great interest in the subject matter) but he is having difficulty understanding : the ideotype and the Multiline Concepts of Plant Breeding.

- a) How would you explain these concepts to him?
b) What would you suggest, with reasons, the ideotypes for Maize and Soybeans in Zambia would be?

- 5.0 a) What are the various sources of genetic variation in vegetative propagated Crops?

- b) Clearly discuss two Breeding Methods you would apply to use the variation created through hybridization and induced mutation in improving vegetative propagated crops such as cassava.

- 6.0 a) Explain the Hardy-Weinberg law and its significance to crop improvement.

Maize of an OPV of high lysine maize was studied for the frequency of the Opaque 2 gene which produces Quality Protein Maize (QPM) that is high in the essential amino acids; lysine and tryptophan. From a random sample of maize cobs, 200,000 kernels were studied for the Opaque 2 gene. Kernels of the following genotypes were obtained:

O_2O_2 (Normal maize)	O_2O_2 (Normal maize)	o_2o_2 (QPM)
40,000	20,000	140,000

- b) Calculate the frequency of the alleles O_2 and o_2 in the above population.
- c) If the rule of thumb is that the threshold proportion for the Opaque plants in the population to have an observable, clinical, nutritional impact on the health of consumers, should be above 65%, did this OPV population comprise of enough High lysine maize plants (QPM) to make a difference in the nutrition of the people consuming this maize?
- d) What about after one generation of random mating, is the proportion still good or not and if not what measures would have to be instituted to improve the nutritional quality of this OPV.
- 7.0 Below are the yields if the Single Cross Experimental Hybrids of Maize including those of the parental lines.

Parent	A	B	C	D	E	F
A	(3.5)					
B	10.0	(4.0)				
C	5.5	6.7	(3.0)			
D	8.5	7.5	6.3	(4.5)		
E	4.7	7.8	6.0	12.5	(5.5)	
F	5.1	8.0	7.8	13.5	8.8	(5.0)

- a) Identify the best General Combiner and the best Specific Combination among the parental lines
- b) Estimate the Hybrid Vigour/Heterosis exhibited among the hybrids and comment on the value of inbred line evaluation in hybrid variety development.
- c) Estimate the Yields of the Following possible Double Cross Hybrids:
- 1) $(A \times B) \times (C \times D)$
 - 2) $(C \times D) \times (E \times F)$
 - 3) $(A \times E) \times (B \times F)$
 - 4) $(A \times B) \times (E \times F)$
 - 5) $(C \times E) \times (B \times F)$
 - 6) $(A \times C) \times (B \times D)$

- 8.0 Africa South of the Sahara still faces many challenges in its Agricultural Advancement. As a student of Plant Breeding, and as a resident of Sub-Saharan Africa:
- a) What do you consider as the three biggest challenges to Agricultural Advancement in the Region
- b) Clearly Discuss the role of Plant Breeders in finding solutions to these challenges.

-----END OF EXAMINATION-----

UNIVERSITY OF ZAMBIA

School of Agricultural Sciences

Department of Crop Sciences

Fifth Year Final Examinations for Bachelor of Agricultural Sciences

AGC 572: POST HARVEST TECHNOLOGY

Second Semester 2009/2010

Date: 30th April 2010

Time 14:00 to 17:00 hrs

INSTRUCTIONS

1. Answer **ALL** questions;
 2. Answer **Each Section in a separate answer booklet**;
 3. Duration- Three (3) hours.
-

SECTION A- [40 marks]

1. Carbon dioxide may function as an anti ripening agent whereas ethylene is a ripening enhancing agent in climacteric commodities. In small- scale systems, mature fruits are usually ripened by enclosed them in air- tight conditions. This may concentrate both these gases but still ripening is enhanced. Using simple biochemical concepts, explain this process.
[10 marks]
2. A considerable proportion of post- harvest losses can be attributed to the failure to control environmental factors. What are the important environmental factors that contribute to losses? Describe the relationship between these environmental causes and the respiration process?
[10 marks]
3. Write short notes on **ANY 3 (three)** of the following;
 - i. Maturity indices;
 - ii. The relationship between the Oxidative pentose phosphate cycle and product ripening.
 - iii. Reasons for higher post harvest losses in small scale farmers.
 - iv. Importance of microbial analysis in a quality control programme.**[20 marks]**

SECTION B [Total marks -40]

1. A farmer engaged in potato production intends to put his produce in storage. How can he ensure that the produce reaches the consumer in optimum condition?
[18 marks]
2. What kind of damage can occur to Lime fruits (*Citrus aurantifolia*) during the packing operation? How is this damage brought about and how can the damage be prevented?
[12 marks]
3. As a Plant Pathologist, you have been requested to present Lecture on Brown rot in citrus to the 3rd Year- Crop Science major students at the Natural Resource Development College. What would you include in your notes? [10 marks].

SECTION C [Total 20 marks]

4. Answer the following questions;
 - i. Explain with the aid of a flow diagram the manufacturing process of dried mango fruits?
[12 marks]
 - ii. Give 2 (two) reasons on how the above process differs from dried vegetable processing?
[2 marks]
 - iii. Frozen spinach is thawed and cooked. The following characteristics are observed on the cooked product; loss of crispness, rubbery mouth-feel, discolouration and loss of flavour. Outline at least 3 (three) possible causes and give the possible solution(s).
[6 marks]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2009 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATIONS

AGE 222: FUNDAMENTALS OF MACRO-ECONOMICS

TIME : THREE (3) HOURS

INSTRUCTIONS : ANSWER ALL FIVE QUESTIONS

(1) Given the following economic system:

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

$$\text{Consumption} = 100 + 0.8Y_d$$

$$\text{Investment} = 60 - 50i$$

$$\text{Taxation} = 20 + 0.1Y$$

$$\text{Government} = 80$$

$$\text{Exports} = 40$$

$$\text{Imports} = 10 + 0.4Y$$

$$Y_f = 650 \text{ full employment output}$$

- (a) Derive the equilibrium equation for Y . (4 marks)
 - (b) If $i = 10\%$. What is the state of the government budget? (4 marks)
 - (c) Is the government pursuing an expansionary, passive or contractionary policy? Explain. (4 marks)
 - (d) Is the balance of trade in deficit or surplus at the equilibrium level of income? (4 marks)
 - (e) What is the value of the multiplier in this economy? (4 marks)
- (2) (a) Explain what is meant by a budget surplus? (5 marks)
- (b) Explain the difference and similarity between frictional and structural unemployment. (5 marks)
 - (c) Explain the relationship between inflation and the rate of unemployment (5 marks)
 - (d) Explain how inflation is measured. (5 marks)
- (3) (a) What is the difference between comparative advantage and absolute advantage? (5 marks)
- (b) Suppose there were two potential trading regions called A and B that produced and

consumed only two goods, food and cloth. With an input of X resources, the production possibilities in each country are:

COUNTRY	FOOD (Units)	CLOTHING (Units)
A	100	10
B	64	8

- (i) Which country has a comparative advantage in the production of clothing? (5 marks)
- (ii) Which country has absolute advantage in the production of food? (5 marks)
- (c) Distinguish between a recession and a recovery. (5 marks)
- (4) (a) What is a discretionary fiscal policy? What are the three problems with discretionary policy? (5 marks)
- (b) Explain the tools that Central Bank uses to control money supply. (5 marks)
- (c) What is the difference between nominal exchange rate and real exchange rate? (5 marks)
- (d) Explain in detail the functions of money (5 marks)
- (5) Explain what you understand by the following terms:
 - (a) The GDP deflator.
 - (b) Inflationary gap.
 - (c) Business cycle.
 - (d) Open market operations.
 - (e) Dumping.

END OF EXAM

The University of Zambia
University Second Semester Examinations – April 2010
AGE 442

Agribusiness Statistics and Data Analysis

Instructions: There are two sections in this exam. Answer all three questions in section A; and any one of the two questions in section B.

Time: Three (3) hours

SECTION A

1. The following table contains the achievement test (or *ACT*) scores and the grade point average (*GPA*) for 8 college students. Grade point average is based on a four-point scale and has been rounded to one digit after the decimal.

Student	GPA	ACT
1	2.8	21
2	3.4	24
3	3.0	26
4	3.5	27
5	3.6	29
6	3.0	25
7	2.7	25
8	3.7	30

- a) Estimate the relationship between *GPA* and *ACT* using OLS; that is, obtain the intercept and slope estimates in the equation

$$\hat{GPA} = \hat{\beta}_0 + \hat{\beta}_1 ACT$$

- b) Comment on the direction of the relationship.
c) Does the intercept have a useful interpretation here? Explain.
d) Compute the fitted values and residuals for each observation and verify that the residuals (approximately) sum to zero.
e) What is the predicted value of *GPA* when *ACT* = 20?

2. OLS on an import model gives the following results

$$\hat{M}_t = -201.80 + 0.14 GDP_t, \\ \quad \quad \quad (-6.48) \quad (29.44) \\ n = 20 \quad R^2 = 0.98 \quad d = 0.54$$

where \hat{M}_t is the predicted value of imports in million USD, and *GDP* is gross domestic product also in million USD. At the 5% level of significance with $n = 20$ and $k' = 1$, $d_L = 1.20$ and $d_U = 1.41$.

- a) Test for autocorrelation at the 5% level of significance.
b) Suppose you also obtain the following results,

$$\hat{M}_t = -103.21 + 0.82 M_{t-1} + 0.36 GDP_t - 0.33 GDP_{t-1} \quad R^2 = 0.98. \\ \quad \quad \quad (4.72) \quad (4.68) \quad (-4.23)$$

Use these results and the subset of the data in the following table to correct for autocorrelation (regardless of the test results in a)

Year	M	GDP
1980	299.2	2918.8
1981	319.4	3203.1
1982	294.9	3315.6
1983	358	3688.8
1984	416.4	4033.5
⋮	⋮	⋮

c) Test for autocorrelation on the corrected model in b). Assume $d_L = 1.20$ and $d_U = 1.41$ at the 5% level of significance.

3. Estimation of the model $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + e$ from a sample of 104 observations yields

$$(\mathbf{X}'\mathbf{X})^{-1} = \begin{pmatrix} 5.0 & -1.4 & -2.0 \\ -1.4 & 20.0 & -7.5 \\ -2.0 & -7.5 & 45.0 \end{pmatrix} \quad \mathbf{e}'\mathbf{e} = 20 \quad \hat{\boldsymbol{\beta}} = \begin{pmatrix} 4.8 \\ 4.0 \\ 3.6 \end{pmatrix}$$

where x_1 and x_2 are explanatory variables, and e is the error term. Assume $t_{crit} = 1.980$

- Which of the regressors has a statistically significant effect on y ? Show your work.
- Construct the 95% confidence interval for x_1 . What does it communicate about the statistical significance of x_1 ?

SECTION B

4. Suppose that annual earnings and alcohol consumption are determined by the SEM

$$\log(\text{earnings}) = \beta_0 + \beta_1 \text{alcohol} + \beta_2 \text{educ} + u_1$$

$$\text{alcohol} = \gamma_0 + \gamma_1 \log(\text{earnings}) + \gamma_2 \text{educ} + \gamma_3 \log(\text{price}) + u_2$$

where price is a local price index for alcohol. Assume that educ and price are exogenous.

- If β_1 , β_2 , γ_1 , γ_2 , and γ_3 are all different from zero, establish identification conditions for each of the two equations
 - Why is it necessary to seek alternatives to OLS when estimating parameters of equations that are part of a system of simultaneous equations?
 - How would you estimate the identified equation(s)?
5. You are conducting an empirical investigation into the median prices of houses in 506 communities of a large metropolitan area ($n=506$), and obtain the following OLS results (standard errors in parentheses):

$$\ln P_i = 11.08 - 0.9535 \ln NOX_i - 0.1343 \ln DIST_i + 0.2545 ROOMS_i - 0.05245 STRAT_i$$

$$(0.3181) \quad (0.1167) \quad (0.0431) \quad (0.0185) \quad (0.0059)$$

$$SSR = 35.1835; \quad SST = 84.5822$$

where 'ln' = the natural log operator;

P = the median house price in community i , in dollars;

NOX = the level of nitrous oxide in the air of community i , in parts per 100 million;

$DIST$ = the weighted distance of community i from 5 employment centres, in miles;

$ROOMS$ = the average number of rooms per house in community i ;

$STRAT$ = the average student-teacher ratio of schools in community i ;

SSR = Residual sum-of-squares;

SST = Total sum-of-squares.

Assume further that $t_{\left(\frac{\alpha}{2}=0.025; n-k=501\right)} = 1.96$; and $F_{(\alpha=0.05; k-1=4, n-k=501)} = 2.37$

- Interpret the slope coefficient estimates for $\ln NOX$ and $ROOMS$.
- Test for the individual significance of $\ln NOX$ at 5% level of significance.
- Test for the significance of all the explanatory variables together. Assume $\alpha = 0.05$.
- Construct the 95% confidence interval for $\ln DIST$ and use it to test for the significance of $\ln DIST$.
- How much of the variation in $\ln P$ is explained by the model?
- Between NOX and $DIST$, which one is more important in this model? Explain.

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2009/10 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATIONS

AGE 562: FARM MANAGEMENT II

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL FIVE QUESTIONS

Each Question Carries 20 Marks

- Q1 a)** Farm work does not occur evenly throughout the year; busy periods or peak periods alternate with slack periods. Explain the reasons for this occurrence and suggest ways in which a farmer can accomplish his/her tasks under such conditions. **(15 marks)**
- b)** Agricultural labor management is more than scheduling employees to milk, plant crops, or repair machinery. It also requires you to be a good personnel manager. Outline five (5) indicators of strong personnel management skills **(5 marks)**
- Q2 a)** Ownership is one of the ways in which a farmer can have control of land. Briefly outline five (5) ways in which land exchange hands from one farmer to another. **(10 marks)**
- b)** Give two advantages and two disadvantages for a tenant under a crop share lease **(4 marks)**
- c)** Land use decisions made by farmers need to consider long run environmental effects and conservation should be a major practice in farm management. Define what conservation is and give four examples of conservation practices that a farmer can undertake to ensure both short term and long term productivity and profitability of the farm. **(6 marks)**
- Q3 a)** A Kalabo farmer with 600 acres each of wheat and millet to harvest annually is considering two sizes of combine harvesters. The medium combine and the large size combine. Their header sizes, speed, efficiency and hours of operation/day in each crops are as shown in the table below:

Item	Medium size combine		Large size combine	
	Wheat	Maize	Wheat	Maize
Header size in feet	17	13	21	18
Speed in miles per hr	4.25	4.10	4.50	4.25
Efficiency	0.8	0.8	0.8	0.8
No. of hrs of operation per day	7	10	7	10

- i) How many acres of a) wheat and, b) maize can each of the combines harvest per day? **(4 marks)**
 - ii) Calculate the field days needed to harvest a) wheat and b) maize for each of the combines **(4 marks)**
 - iii) Suppose the weather allows only 20 days harvesting both wheat and maize, which combine should the farmer select? **(4 marks).**
- b) Suppose the farmer uses equity in form of savings and investor's money to finance his business. Advise the farmer on the advantages and disadvantages of each of these sources. **(8 marks)**

Q4. a) On its 2010 farm records Namatama farm has the following:

Farm records of Namatama Farm (K, 000,000) as at December 31st 2010

Cash income from livestock sales: K15	Hired labor: 5 months
Total Revenue: K98	Crop land: 120 hectares
Total farm expenses: K46	Pasture land: 140 hectares
Changes in livestock inventories K 5	Machinery depreciation: K1.5
Interest Expense K14	Value of total farm assets: K596
Combine lease payment/ year K7.5	Income from non farm work: K 7.5
Total depreciation Expense K4.5	Machinery fuel & repairs: K3.5
Value of purchased livestock: K6.5	Personal Taxes: K15
Family Labor: 8 months	Opportunity cost of all labor: K25
Operator's labor: 12 Months	Opportunity cost of management: K15
Family withdrawals: K18.9	Value of feed fed: K 0.5

Using the above information for Namatama farm, estimate the following:

- i) Gross revenue per person **(3 marks)**
- ii) Machinery cost per crop hectare **(3marks)**
- iii) Cash available for debt payment **(4 marks)**
- iv) Safe debt amount this farm can get with the cash available annually (as in iii), assuming 12% interest with 8 years of equal total payment loan. **(7 marks)**
- v) Livestock Production per cost of feed fed **(3 marks)**

Q5. a) Distinguish data from information and explain why this distinction is necessary in the control function of management. **(4 marks)**

b) Briefly outline tests of liquidity on a farm business **(12 marks)**

c) Assume Amai Lungu borrows K42 million at 13 % add-on interest from a bank to be repaid over 4 years with 6 months equal installment payments. Calculate the true annual interest rate paid **(4 marks)**

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2008/2009 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATIONS

29th APRIL 2010

AGE 582: PROJECT MONITORING AND EVALUATION

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER FOUR FOR A TOTAL OF FIVE. EACH QUESTION IS WORTH 20%.

1. You are hired as a Consultant to conduct a Mid-term Evaluation for an agricultural project. The project's overall goal is to improve wheat production among smallholder farmers in Sinafala Camp, and its deliverables are: Construction of a dam; Installation of 1 ha Irrigation systems among 200 farmers; Provision of training services in wheat production and irrigation maintenance. Briefly explain the items that you would examine in a comprehensive Mid-term Evaluation. **(20 marks)**
2. (a) Citing appropriate examples, define the terms "Project", "Objectives", "Inputs", "Outputs", "Effects" and "Impact". **(10 marks)**

(b) Define and elaborate on the purposes of Monitoring and Evaluation in project management. Comment on the distinction between monitoring and evaluation. **(10 marks)**
3. Monitoring and Evaluation is conducted at the project and sectoral levels. What is a Sectoral Analysis? What is the importance of a Sectoral Analysis? Outline the stages involved in a typical Sectoral Analysis. **(20 marks)**
4. What are the practical applications of monitoring and evaluation at project level? (Hint: Consider all the stages of the project cycle) **(20 marks)**
5. Nambala Community Project (NCP) is a project that works in Nambala catchment area. The area has a population of **1000** farming households producing cotton. Prior to project implementation, all these farmers had low incomes from their cotton production due to the low quantities and poor quality cotton; coupled with poor market prices.

NCP then came in and started working with **250** of these farming households.

Their main project intervention was in providing these farmers with certified cotton planting materials; training services in the production and management of cotton; and market linkage services for better cotton prices.

Just before project implementation commenced, the project M&E team collected baseline data on the 250 farm households. Some of the data collected included income data from cotton production and other farm business activities. The baseline data revealed that the average cotton earning of the farmers was **K600, 000**.

You have been engaged as an external evaluator for this project to determine its impact on its beneficiaries. The project impact you have been asked to evaluate is in the context of income from cotton production and sales.

- a. Of the three Quasi Experimental (QE) designs discussed in class, which one is the **most appropriate** to determine the project impact? (**2 marks**)
 - b. Based on this project, give an illustration of the QE design you selected in (a), showing how you would measure this impact. (**8 marks**)
 - c. Give some justification for using the QE design selected in (a). (**4 marks**)
 - d. What are the limitations of the QE design selected in (a)? (**4 marks**)
 - e. How can you improve the quality and usefulness of the results obtained from the QE design selected in (a)? (**2 marks**)
6. Write brief notes explaining the main differences between the following:
- a. Mono-method Approaches and Multi-method Approaches (**5 marks**)
 - b. Interval data and Nominal data (**5 marks**)
 - c. Terminal Evaluation and On-going Evaluation (**5 marks**)
 - d. Systems Analysis and Process Modeling (**5 marks**)

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
2010 SECOND SEMESTER EXAMINATIONS

AGS222
FUNDAMENTALS OF SOIL SCIENCE

DURATION: 3 hours

INSTRUCTIONS: Answer all Questions

MARKS: 100

-
1. Indicate whether the following statements are true or false, or whether you do not know the correct answer. (17. 5 marks) *2.5 marks for correct answer, -1.25 for wrong answer and 0 if you indicate that you do not know the correct answer.*
- a) Pure water held in soil pores with a diameter of $10\mu\text{m}$ has a lower potential than water at equilibrium with air that has a relative humidity of 98.5 % at 25°C .
 - b) A 50 kg bag of urea (46% N) contains more nitrogen than 150 kg of diammonium phosphate $(\text{NH}_4)_2\text{HPO}_4$.
 - c) Pure (100%) dolomite $\text{CaMg}(\text{CO}_3)_2$ has a higher Neutralizing Value than 80 % pure magnesite (MgCO_3) .
 - d) Aluminium toxicity to plants is more likely to be a problem in acid mineral soils than in acid organic soils.
 - e) An aluminium saturated kaolinitic soil is more likely to be prone to gully erosion than a sodium saturated smectitic soil when both soils have the same clay content.
 - f) Magnesium and Sulphur are micronutrients referred to as secondary nutrients in fertilizer terminology
 - g) A soil containing $0.2\text{ cmol Al}^{3+}/\text{kg}$ with an Al saturation of 10 % can only be sodic if it contains more than $69\text{ mg Na}^+/\text{kg}$ soil.

Atomic masses: Ca= 40g Na =23g, Mg =24g, C=12g, O=16g, S=32 g P=31g, H=1g, N=14g, Cl =35.5

2. Define the following terms (7. 5 marks)
- a) Isomorphous substitution
 - b) The Inner sphere complex of a soil colloid
 - c) Organic fertilizer
 - d) Neutralizing Value of a liming material
 - e) Osmotic Potential

3. Answer the following questions briefly and concisely (30 marks)

a) A layer silicate mineral has the formular $Mg_{0.3} Na_{0.2} Al_2 (Si_{3.3} Al_{0.7}) O_{10} (OH)_2$. Answer the following questions about this mineral:

- What is the name of the mineral? Give reasons to support your answer. (1.5 marks)
- Draw a schematic diagram of the mineral and indicate the planes in the structure, where the elements in the formula occur? (5 marks)
- Discuss the CEC, specific surface area, and ability of the above mineral to expand and contract in relation to its crystal structure. (4 marks)
- Is this mineral dioctahedral or trioctahedral? Give reasons to support your answer. (1.5 marks)

b) List the 13 nutrients that plants normally obtain from soil, indicate their classification according to (i) plant nutrition (ii) fertilizer industry and indicate their bioavailable forms. (6 marks)

c) List and define the components of the total acidity of a soil and describe each is determined in practice. (6 marks)

d) List and describe the three mechanisms by which nutrients in the soil reach the surfaces of plant roots and indicate the soil conditions that promote nutrient uptake through these mechanisms. (6 marks)

4 A soil from Malashi in Mpika District has the following selected physical and chemical properties. (25 marks)

Depth	pH	Org C	pb	Available P	Ca^{2+}	Mg^{2+}	Na^+	K^+	Al^{3+}	H^+	CEC	pH _{7.0}	θ_g
	(CaCl ₂)	%	g.cm ⁻³	mg/ kg soil	-----cmol/kg soil -----					-----		--gH ₂ O/gsoil--	
0 -20cm	4.2	0.6	1.45	9.4	0.2	0.3	0.01	0.20	0.7	0.4	4.4	0.18	

Answer the following questions.

- Give the agronomic classification and interpretation of the pH of this soil. (2.5 marks)
- Express the actual active acidity of the soil as a percentage of the total acidity of the soil based on the CEC at pH 7.0? (2.5 marks)
- Calculate the Effective CEC of this soil and the base saturation based on the ECEC for this soil? (2.5 marks)
- Calculate the % of the CEC at pH 7 due to organic matter, and the apparent CEC of the soil. Also indicate the likely dominant type of clay present in the soil. Give reasons to support your answer. (5 marks)

- v) Would the amounts of available P and K present in 1 hectare of this soil together with an application of 200 kg of diammonium phosphate $((\text{NH}_4)_2\text{HPO}_4)$ be adequate to meet the needs of a Sugarcane crop that requires 70 kg P/ha and 170 kg K/ha? Show calculations to support your answer. (5 marks)
- vi) How many litres of irrigation water containing 25mg CaCO_3 per liter would be required to neutralize the active acidity associated with the water present in 1 lima (0.25 ha) of this soil? (2.5 marks)
- vii) How much lime is required per hectare to reduce the Al saturation of the soil to 10 %, if the available liming material has a Neutralizing Value of 85 %? (5 marks)
- 5 A 20 metre tall Marula tree in the Gwembe Valley is growing on a salt affected soil. If the water in contact with its roots at 2.5 m below the soil surface has a concentration similar to that of 156 grams of Na_2SO_4 dissolved in 1 kg of water at 30° C, while the water is held in soil pores with a mean diameter of 15µm, answer the following: (20 marks)
- i) Calculate the matric, osmotic, and gravitational potentials of the soil water at 2.5 m soil depth assuming the soil surface the top of the marula tree is the reference level. (5 marks)
- ii) What is the relative humidity of the soil at 2.5 m soil depth at 30° C? (2.5 marks)
- iii) Calculate the total energy required to obtain and transport 10 litres of pure water from the 2.5 m soil depth to the top Marula tree at 25°C? (5 marks)
- iv) If the air temperature in contact with the leaves at the top of the tree is 25°C and has a relative humidity of 45%, and the relative humidity of the soil at 50cm depth is 75 % at 25 °C, calculate the total water potentials of the soil at (i) 2.5 m soil depth, (ii) 50 cm soil depth and (iii) at the top of the Marula tree if the top of the tree is the reference height. (5 marks)
- v) Express the total water potentials at the three points in the above question (iv) in units of pF and indicate the direction in which water will flow among the three points. (2.5 marks)

Note: Some useful Atomic numbers: Na = 23g, Cl = 35.5g, S=32g, N=14g, H= 1g O = 16g, P= 31g

SOIL SCIENCE IS FUN

END OF EXAMINATION

- v) Would the amounts of available P and K present in 1 hectare of this soil together with an application of 200 kg of diammonium phosphate $((\text{NH}_4)_2\text{HPO}_4)$ be adequate to meet the needs of a Sugarcane crop that requires 70 kg P/ha and 170 kg K/ha? Show calculations to support your answer. (5 marks)
- vi) How many litres of irrigation water containing 25mg CaCO_3 per liter would be required to neutralize the active acidity associated with the water present in 1 lima (0.25 ha) of this soil? (2.5 marks)
- vii) How much lime is required per hectare to reduce the Al saturation of the soil to 10 %, if the available liming material has a Neutralizing Value of 85 %? (5 marks)
- 5 A 20 metre tall Marula tree in the Gwembe Valley is growing on a salt affected soil. If the water in contact with its roots at 2.5 m below the soil surface has a concentration similar to that of 156 grams of Na_2SO_4 dissolved in 1 kg of water at 30° C, while the water is held in soil pores with a mean diameter of 15µm, answer the following: (20 marks)
- Calculate the matric, osmotic, and gravitational potentials of the soil water at 2.5 m soil depth assuming the soil surface the top of the marula tree is the reference level. (5 marks)
 - What is the relative humidity of the soil at 2.5 m soil depth at 30° C? (2.5 marks)
 - Calculate the total energy required to obtain and transport 10 litres of pure water from the 2.5 m soil depth to the top Marula tree at 25°C? (5 marks)
 - If the air temperature in contact with the leaves at the top of the tree is 25 °C and has a relative humidity of 45%, and the relative humidity of the soil at 50cm depth is 75 % at 25 °C, calculate the total water potentials of the soil at (i) 2.5 m soil depth, (ii) 50 cm soil depth and (iii) at the top of the Marula tree if the top of the tree is the reference height. (5 marks)
 - Express the total water potentials at the three points in the above question (iv) in units of pF and indicate the direction in which water will flow among the three points. (2.5 marks)

Note: Some useful Atomic numbers: Na = 23g, Cl = 35.5g, S=32g, N=14g, H= 1g O = 16g, P= 31g

SOIL SCIENCE IS FUN

END OF EXAMINATION

- v) Would the amounts of available P and K present in 1 hectare of this soil together with an application of 200 kg of diammonium phosphate $((\text{NH}_4)_2\text{HPO}_4)$ be adequate to meet the needs of a Sugarcane crop that requires 70 kg P/ha and 170 kg K/ha? Show calculations to support your answer. (5 marks)
- vi) How many litres of irrigation water containing 25mg CaCO_3 per liter would be required to neutralize the active acidity associated with the water present in 1 lima (0.25 ha) of this soil? (2.5 marks)
- vii) How much lime is required per hectare to reduce the Al saturation of the soil to 10 %, if the available liming material has a Neutralizing Value of 85 %? (5 marks)

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- i) Calculate the matric, osmotic, and gravitational potentials of the soil water at 2.5 m soil depth assuming the soil surface the top of the marula tree is the reference level. (5 marks)
- ii) What is the relative humidity of the soil at 2.5 m soil depth at 30° C? (2.5 marks)
- iii) Calculate the total energy required to obtain and transport 10 litres of pure water from the 2.5 m soil depth to the top Marula tree at 25°C? (5 marks)
- iv) If the air temperature in contact with the leaves at the top of the tree is 25 °C and has a relative humidity of 45%, and the relative humidity of the soil at 50cm depth is 75 % at 25 °C, calculate the total water potentials of the soil at (i) 2.5 m soil depth, (ii) 50 cm soil depth and (iii) at the of top the Marula tree if the top of the tree is the reference height. (5 marks)
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Note: Some useful Atomic numbers: Na = 23g, Cl = 35.5g, S=32g, N=14g, H= 1g O = 16g, P= 31g

SOIL SCIENCE IS FUN

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SEMESTER EXAMINATIONS, APRIL 2010

AGS 422: Soil Microbiology

ME: 3Hrs

MARKS: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS CONCISELY. WRITE LEGIBLY AND IN ESSAY FORMAT FOR ALL DISCUSSION AND DESCRIPTIVE QUESTIONS

(a) Describe some specific economic importance of bacteria. [6]

(b) Describe the similarities and dissimilarities between actinomycetes and fungi [6]

Describe the characteristics of growth media and conditions specific for the isolation and selection of fungi, algae and N_2 -fixing bacteria. [10]

(a) How many large bacteria can occupy the entire surface of a large clay particle? [8]

(b) Illustrate a serial dilution you would carry out on 5 dm^3 of a broth containing 1 billion cells in order to achieve a concentration of only $10^5\text{ cells cm}^{-3}$ suitable for inoculating 250g of solid media in sachets. [5]

(c) Given that the bacteria in (b) above reproduces by binary fission and has a generation time of 2 hours, calculate how long the bacteria should be incubated in broth culture under optimal conditions in order to obtain 1 billion cells from an initial $10^4\text{ cells cm}^{-3}$ [10]

Describe an experiment you would conduct to validate a claim that a certain cultural practice resulted in biological soil degradation. [10]

Consider the decomposition of maize stover with a C/N ratio of 60:1 that is incorporated into soil.

(a) How much humus will be formed under normal conditions without additional N? [5]

(b) How much inorganic nitrogen should be added in order to optimize the humification of these residues? [5]

- (c) How much humus would then be formed in (b). given adequate N? [5]
6. Nitrification is often referred to as a “mixed blessing”.
- (a) Explain what is meant by the statement? [4]
- (b) Describe how nitrification can be counteracted in practice in order to achieve N use efficiency in crop production [10]
7. (a) A target maize grain yield of 5 t ha^{-1} requires the supply of 110 kg N ha^{-1} . Would an application of 5 t ha^{-1} of crushed jatropha seed cake containing 3.5% organic matter with a C:N ratio of 12:1 and a mineralization rate of 0.143 week^{-1} meet this requirement? [10]
- (b) How much mineral (kg N ha^{-1}) would be available to the crop per season, assuming that the soil contained 1.2% organic matter (C:N ratio of 15:1) in the plough layer and had a bulk density of 1.3 kg m^{-3} . [10]

END OF EXAMINATION