SCHOOL OF AGRICULTURAL SCIENCES

2005 ACADEMIC YEAR- SECOND SEMESTER FINAL EXAMINATIONS

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THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2005 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 (20).
b)   Answer any five (5) questions, **at least one from each section.**

SECTION A – BEFF PRODUCTION:

Q.1.   Extensive beef producers in Monze District have heard about the possibility of using the fertiliser "urea" as an animal feed. As a graduate of the University of Zambia prepare detailed notes for your presentation on the reasons for its use and how the fertiliser "urea" should be used as cattle feed. What are the precautions that should be taken into consideration in the use of urea?

Q.2   a)   The extensive farmers in Monze District have also heard about the possibility of the use of either the summer or winter breeding seasons. Which of the two breeding seasons would you recommend to them? Highlight the merits and demerits of its use.

c)   The indigenous beef breeds of cattle are said to be very well adapted to rear in Zambia. What are their characteristics that make them more suitable to rear in Zambia? Mention any two (2) indigenous breeds of cattle found in Zambia.

SECTION B – DAIRY PRODUCTION:

Q.3   The dairy cow has been described as "the foster mother of the human race" because of the universal acceptance of the cows' milk. Write notes on any five (5) physiological factors that may affect the composition of milk on a dairy farm of your choice.

Q.4   Write notes on the following:

a)   The milk ejection process.
b)   Galactopoeisis.
c)   The process of pasteurization and the possible milk contaminants

SECTION C – SHEEP AND GOAT PRODUCTION:

Q.5 The University of Zambia intends to establish a commercial Sheep and Goat Unit at Liempe Farm. You have been recently recruited to manage the enterprise. Discuss any ten (10) lamb and kid routine management practices you intend to put in place to ensure that the unit operates profitably.

Q.6 Write notes on the following:

a) The advantages of rearing sheep and goats in Zambia as compared to other types of livestock.

b) The factors that should be taken into consideration in the selection of sheep and goat breeding stock.

SECTION D – RABBIT PRODUCTION:

Q.7 The extension service of the Government of the Republic of Zambia (GRZ) is involved in the promotion of rabbit production in the country. As a rabbit production expert stationed in Lusaka District, discuss any ten (10) reasons/advantages over other forms livestock production to convince interested would-be rabbit producers to start rabbit enterprises.

Q.8 a) A breeding routine is also good management. Discuss the breeding routine that you would put in place at rabbit farm of your choice.

c) What factors would you take into consideration in selecting good breeding rabbits?

END OF EXAMINATION

AGA332: APPLIED ANIMAL NUTRITION

TIME: THREE HOURS
INSTRUCTIONS: ATTEMPT ALL QUESTIONS
              THE FIVE QUESTIONS CARRY EQUAL MARKS

1. A Farmer is seeking advice on the best way to use his nice growing crop of rhodes grass for dry season feeding to a herd of beef animals. Provide the advice highlighting major points/aspects that he should consider.

2. Discuss the attributes of the following materials as ingredients in livestock feeds:

    i)   Tallow
    ii)   Soybean
    iii)   Urea
    iv)   Fish meal

3. Formulate a feed supplement for a herd of 500 beef animals averaging 200kg in body weight that should be adequate for a 7-day feeding period using information given below:

Requirements per day;
2.5kg roughage DM, 0.58kg total protein, 12.7Mcal ME, 0.014kg calcium, 0.01kg phosphorus and 40mg carotene.

Available ingredients and their composition

Ingredient	DM%	TP%	ME Mcal/kg	Ca%	P%	Carotene mg/kg
Hay	90	6	1.8	.30	.15	25
Maize bran	-	9	2.8	.02	.05	-
Cotton seeds	-	38	2.4	.02	.06	-
Tallow	-	-	7	-	-	-
Limestone	-	-	-	38	-	-
DCP	-	-	-	22	18	-

4. Formulate a mineral premix to supply (per kilogram of feed) 150mg Fe, 15mg Cu, 80mg Zn and 100mg Mn which should be used in 10,000kg of feed at a rate of 0.1%.

The following materials with indicated mineral composition are available for mixing:

    i)   Ferrrous sulphate (33% Fe)
    ii)   Copper sulphate (25% Cu)
    iii)   Zinc oxide (80% Zn)
    iv)   Manganese oxide (62% Mn)

5. For requirements of 24% crude protein and 3000kcal/kg ME, formulate a feed mixture using ingredients listed below assuming that mineral and vitamin premixes are to be used at a rate of 1% each.

Ingredient	%CP	ME kcal/kg
Maize meal	8.8	3300
Sunflower meal	35	2600
Vegetable oil	-	7500
Salt	-	-
Mineral premix	-	-
Vitamin premix	-	-

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THE SCHOOL OF AGRICULTURAL SCIENCES

2005 ACADEMIC YEAR – SECOND SEMESTER FINAL EXAMINATIONS

COURSE AGA 342 – ANIMAL BREEDING AND GENETICS

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:
a)   All Questions carry equal marks (20).
b)   Answer any five (5) questions, clearly showing all the calculations.

Q.1   Outline the structure of Deoxyribonucleic Acid (DNA) in relation to its function as a carrier of genetic information. How is this information translated to the sequence of amino acids in proteins?

Q.2   a)   Explain the sequence of events that take place during Prophase I of Meiosis and indicate their genetic consequences.

   b)   Assume that in a randomly mating closed and large population the following genotypes occur at the following frequencies: AA = 30%, Aa = 65% and aa = 5%. Is this population at Hardy-Weinberg Equilibrium? State the Hardy-Weinberg Law.

Q.3   a)   Assume that in monkeys the three pairs of alleles +/r, +/s and +/t are a linkage group. As shown by the symbols, each mutant allele is recessive to its wild type allele. A cross between females heterozygous at the three loci and the wild type males gives the following results:

+++	30
++t	36
+s+	436
+st	0
r++	2
r+t	427
rs+	31
rst	38

   What is the sequence of these linked genes in their chromosome? Calculate the map distance between the genes and the Coefficient of Coincidence.

   b)   Given that the genes X, Y and Z are linkage group with 12% recombination between X and Y, and 20% recombination between Y and

Z; and that the Coefficient of Coincidence is 0.5, what are the expected frequency of phenotypes from a test cross whose progeny are 1000?

Q. 4 a) What do you understand by the terms Cross Breeding as opposed to Inbreeding? What are their effects?

b) Given the pedigree (arrow diagram) below, work out the Coefficient of Inbreeding, F and the Coefficient of relationship, R. Comment on the answers you get.
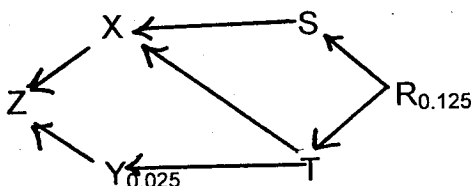
Q.5 a) Calculate the heritability (h^2) of live-weight gain (LWG) steers in the feedlot given that the live-weight gain (kg/days) of the 9 bulls (x) at the University of Zambia's Liempe Farm is as appended below and corresponding is the average live-weight gain (kg/days) of their progeny (y):

Dam No.	X	Y
I	1.10	1.00
2	0.90	0.95
3	0.95	1.00
4	1.00	1.20
5	1.05	1.00
6	1.00	1.00
7	0.85	1.00
8	0.90	0.95
9	1.00	1.05

b) Non-statistical approaches may be used to calculate the heritability (h^2) of any given trait. What is the approach? Illustrate with the help of an example how the heritability (h^2) of the trait of your choice can be calculated.

Q.5 Write notes on the following:

a) The Laws of Inheritance.
b) Sex determination and sex linkage.
c) Progeny Testing.
d) Chromosomal Mutations

END OF EXAMINATION

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THE UNIVERSITY OF ZAMBIA

END OF SECOND SEMESTER EXAMINATIONS
DECEMBER 2005

COURSE AGA 412 – PIG AND POULTRY PRODUCTION

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

i. Answer all five (5) questions.
ii. All questions carry equal marks.

Q1. Write short notes on any four of the following:
  a. Hand mating in pigs
  b. Scours in piglets.
  c. Controlling external parasites in pigs
  d. Selection criteria for hatching eggs.
  e. Pulmonary hypertension syndrome.
  f. Moulting in layers. ·

Q2. There are several situations which precipitate aggressive behaviour in pigs:
  a. Write on any five situations which could lead to aggressive behaviour in different ages of pigs.
  b. What are the common biochemical processes that are associated with aggressive behaviour?
  c. What effect do these processes have on the performance of the affected pigs?

Q3. Whenever pigs or chickens are housed in large numbers it becomes inevitable to use chemical disinfectants to reduce microbial loads in the houses. Write on any four disinfectants you would use to disinfect pig or chicken houses, indicating the advantages and disadvantages of their use.

Q4. Explain the importance of the main facilities that are expected to be in a hatchery in order for it to operate successfully in hatching healthy chicks.

Q5. Compare and contrast the predisposing factors to mortality in free-range reared (scavenging) chicks and intensively reared chicks.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER UNIVERSITY EXAMINATIONS

DECEMBER 2005

AGA 422: GAME RANCHING

TIME: THREE HOURS

INSTRUCTIONS: QUESTIONS **ONE (1)** AND **TWO (2)** ARE **COMPULSORY**.
ANSWER QUESTIONS **ONE (1)** AND **TWO (2)** AND THREE (3) OTHERS.
ILLUSTRATE YOUR ANSWERS WHERE NECESSARY.

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1. You are required to use the map provided to answer this question. Study the map carefully.

   It is assumed that you have just completed an ecological study of the area, and from this study answer the following questions:

   (i)   Which habitat is most important for each of the following species and why?

         (a) *Tragelaphis spekei*
         (b) *Equus burchelli*
         (c) *Damaliscus lunatus*
         (d) *Struthio camelus*

   (ii)   Describe the process which you might recommend in establishing this area as a Game Ranch or a Protected Area within the community.

2. A rodent survey in the Nampundwe area used a capture-recapture method to determine the population of the Cane Rat (*Thryonomys swinderianus*). Twenty (20) traps were set at different points along each transect in the area for 2 occasions, and each captured rat was marked and released. The following data were obtained. The following data were obtained. (i) Using the Lincoln – Petersen method, calculate the populations of the rat in the area, and (ii) Discuss the differences between this method and the Schnabel method in assessing wildlife populations.

TRAPS	A	B	C	D	E	F	G
Initial Capture	6	9	23	14	18	7	3
Second Capture	12	13	11	9	15	10	12
Recaptures	3	8	3	5	7	4	2

3. Zambezi - Samaki Farms Ltd is considering establishing a game ranch in the Choma District along the Munyeki stream. Initial investigations show that the range is suitable for Impala, Zebra, Wildebeest, kudu and Buffalo. The range is relatively flat, well watered and nearly all the range is within 3.5km from water. Based on the information from the Ministry of Agriculture, Food and Fisheries (MACO) in Choma, the soils are generally excellent for the game ranch. Also results from your preliminary estimates indicate that the production of key forage species averages about 100kg/ha of dry matter per year. The ranch is 8000 ha in size. Assuming that allowable use is 30% and daily dry matter intake is 2% of the animal body weight, how many:

    (i)   230 kg Sable antelope, and
    (ii) 800 kg Buffalo, can you stock as your base herds in the area.

4. State the main advantages and disadvantages of using chemical animal capture method in restraining wildlife species, and discuss difficulties associated with the translocation and restocking operations in wildlife management.

5. Discuss the meaning of the following terms as used in wildlife studies:

    (i) $1 - e^{-H}$
    (ii)   Jolly – Seber method
    (iii) *Panthera pardus*
    (iv)   *Numida meleagris*
    (v)   Aldo Leopold

6. Describe the procedure for establishing a game ranch in Zambia, and discuss limitations associated with game farming in the country.

7. Describe the main characteristics of a wildlife habitat and relate these to the significance of the *Acacia – Combretum* habitat in the conservation of wildlife species in Zambia.

8. Explain the concept of carrying capacity in wildlife species populations as applied to a single population model, and discuss the assumptions and limitations associated with this model.

End of Examination

INFORMATION FOR QUESTION 1

THE MAP AND THE DESCRIPTION OF THE AREA:

Vegetation types:

A: Termitaria grassland

B: Munga woodland

C: Chipya woodland

D: Miombo woodland

E: Hyparrhenia grassland

F: Swamp

The area is located in the western part of Mpika District in Chief Chiundaponde, Northern Province of Zambia. Average annual rainfall is approximately 1300 mm. Lake Bakabaka is a fresh water lake, and has fish. The river is perennial with riparian vegetation mainly *Diospyros sp* and *Zyzygium sp*. The Hot spring is salty. There is only one village of about seven household (or about 40 people). Its main activity is fishing. Farming is done at a low scale in vegetation type E. Hunting is important.

The area is being considered for protection because of its importance to biodiversity. You have been asked to carry out an ecological study of the area. And from your study information, answer question two (2).

MAP FOR QUESTION 1
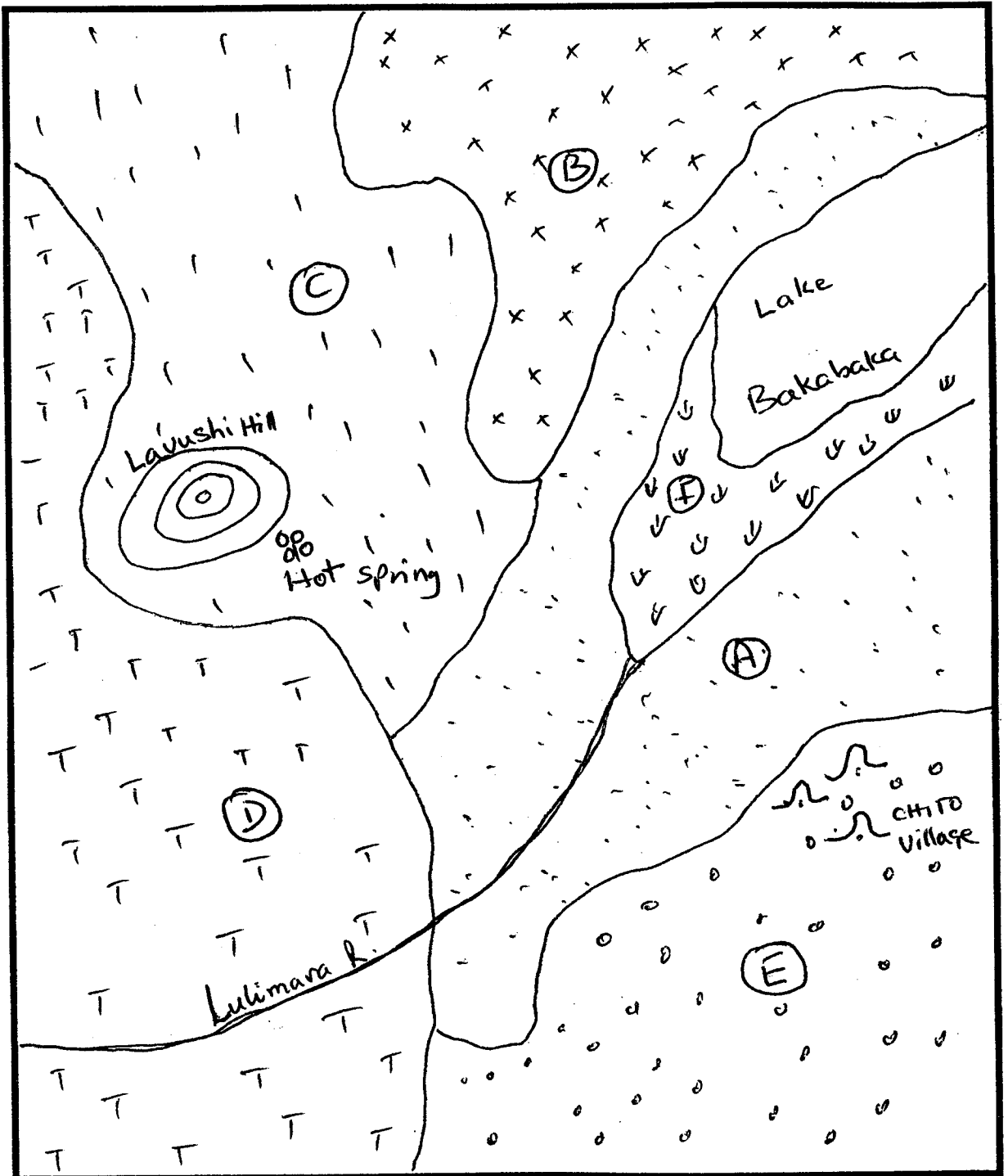
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SCHOOL OF AGRICULTURAL SCIENCES

SECOND SEMESTER UNIVERSITY EXAMINATIONS - DECEMBER 2005

AGA 442 - INTEGRATED AQUACULTURE AND FISH NUTRITION

TIME: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

a)   Answer any two questions in section **A** and any other two questions in section **B.**
b)   At the end of the examination, hand in both your question papers and answer sheets.

SECTION A

Q1.   The following problems are commonly experienced in fish farming:

    i.   Fish gasping atmospheric air.
    ii.   Poor growth rate of fish in ponds.
    iii. Clear water.
    iv. Small number of fish harvested in comparison to the number originally stocked in a pond.
    v.   Excessive water loss in short time intervals

Explain the causes for the conditions indicated above and suggest measures that need to be applied to correct the situation for each problem.

Q2.   *Oreochromis andersonii* is a Cichlid fish recommended for fish farming in most parts of Zambia. Give reasons why this species is suitable for faming in most parts of the country.

Q3.   The *Tilapia species* are known to withstand a wide range of temperatures from 8 - 40° C. However, most cultural species grow rapidly when water temperature is between 20 and 25° C.

    i. Explain how extreme temperatures, below and above 20 - 25° C affect growth of farmed fish and fishpond productivity.

    ii. What are the chemical factors that affect fish growth in extreme temperatures.

SECTION B

Q4. Write notes on the following as related to fish nutrition and aquaculture.

    i.   Live foods.
    ii.   Maize bran as common supplementary feed for fish.
    iii.   Apparent Feed Conversion Ratio.
    iv.   Demerits and merits of organic manures in rural aquaculture.
    v.   Disadvantages of growing Tilapia in rice fields.

Q5. What are the major components of fish feedstuff which are important in designing a feeding program? Discuss their roles and limitations in aquaculture nutrition.

Q6. (i) Discuss the general concepts a fish nutrition expert should initially know if he has to implement a successful fish nutrition program.

    (ii) Classify fish feeds according to the life cycle of fish and explain their importance at each stage.

END OF EXAMINATION

2005 ACADEMIC YEAR SECOND SEMESTER

FINAL EXAMINATIONS

AGA 542:   ANIMAL HEALTH

TIME: THREE HOURS

INSTRUCTIONS: ATTEMT ALL QUESTIONS.

ALL QUESTIONS CARRY EQUAL MARKS.

1. Four-week-old broiler chickens are showing signs of illness, which include picking at their vents, soiled vent feathers, whitish watery diarrhea, ruffled feathers and trembling. Some chickens are dying. What is your tentative diagnosis? What other specific signs are characteristic of this disease? How would you control the disease and prevent further outbreaks?

2. What are the causative agent and clinical signs of Contagious bovine pleuropneumonia (CBPP)? Describe the distribution and control of this disease in Zambia.

3. African swine fever is an economically important disease threatening the future of pig production in Africa. Describe the cause, epidemiology, clinical signs and control of this disease in Zambia.

4. Describe the methods used in the control of ticks.

5. a) State the routes available for drug administration to domestic animals.

    b) Animal diseases will always affect human welfare. State the ways in which animal disease may affect human welfare.

    c) List the direct and indirect costs of disease.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
2005/2006 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGA 552   ANIMAL PRODUCTS AND BY-PRODUCTS

TIME ALLOWED: THREE HOURS
INSTRUCTIONS: ANSWER **ALL** QUESTIONS

QUESTION 1 [30 points]

(a) Discuss reasons why it is important to control milk hygiene. **[8]**

(b) Briefly describe the stages involved in milk processing. **[12]**

(c) Further to (b) above, pasteurization is a heat treatment procedure aimed at prolonging shelf life, improving quality and safe guarding human health. Describe how these aims are achieved and the methods employed in this type of heat treatment. **[10]**

QUESTION 2 [32 points]

When an animal is slaughtered, the muscle does not instantaneously stop living and become meat. Biochemical reactions occur in muscles in the initial post-mortem period in an attempt to maintain homeokinesis. These reactions cause profound changes in the physical characteristics of muscle and constitute the processes collectively referred to as **"Conversion of Muscle to Meat."** Briefly describe these reactions and physical changes in a beef carcass over a 24-hour period.

QUESTION 3 [20 points]

a) In egg production, a deviation in the mechanics of egg-laying will periodically create abnormal eggs. Please describe these abnormalities. **[14]**

b) Briefly discuss health problems attributed to eggs. **[6]**

QUESTION 4 [18 points]

You have observed that smallholder traditional farmers are losing lots of money through low-grade skins and hides as a result of extensive damage.

a) Briefly describe three common causes of this damage to skins and hides, other than parasitic infestation, and fungal and viral infections of the skin. **[9]**

b) What preventive measures would you recommend to these farmers to cut down the economic loss resulting from the damage to skins and hides by the three factors you described in 4 (a). **[9]**

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END OF EXAMINATION

Thank you for being with me in the course. Wishing you a very Merry Christmas & Happy New Year!

2

TIME: 3 HOURS

INSTRUCTIONS: ANSWER ANY FIVE (5) QUESTIONS.

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1. a. Explain what is meant by "discontinuous" variation with respect to traits in farm livestock.

    b. A young polled Hereford bull has parents that are also polled. This young bull is full-sib to an older horned heifer. What is the probability that this young bull is heterozygous (Pp)?

    c. Explain a use of the Chi-square test in conjunction with animal breeding data.

    d. Is mutation a potent force in changing gene frequency in most economically important species? Give explanations for your answer.

    e. Should a commercial calf producer practice inbreeding? Give reasons for your answer.

2. After graduating from UNZA your uncle gave you a he-goat named Billy (B) and a doe named Agnes. The two goats had twins D, a he-goat, and E, a female goat. D mated with C, your neighbor's doe, and had P a he-goat. E mated with G, your neighbor's buck and produced Q. P and Q mated and produced X.

    a. Sketch the pedigree for your goats.

    b. Calculate F_x

    c. Calculate R_{PQ}

    d. Later on, D and E mated and produced S. What is the relationship between the inbreeding coefficient of S (F_s) and the coefficient of relationship between D and E (R_{DE})?

3. a. Define or explain "coefficient of inbreeding."

    b. Define or explain "coefficient of relationship."

    c. In what manner does outbreeding affect the likeness between herds within a purebred breed?

d. Explain how heterosis is calculated.

e. How does inbreeding affect gene action known as over-dominance?

4. a. We have cow production records, Average Weaning Weight (AWW) of calves for one year. The herd Average ($\bar{x}$) = 420 kg. The cows were divided into groups (those above average and those below). The mean for the above average group was 459 kg and that for the below average group was 379 kg. Assuming repeatability for this trait to be 0.4, how much (kg of calf) do you expect these two groups to differ (difference in group averages) the next year?

b. In an analysis of variance, the following components were calculated in swine data:
$\sigma_w = 0.147$ (within litter mates)
$\sigma_w = 0.092$ (dams)
$\sigma_w = 0.0205$ (sires)

Calculate heritability for this trait.

5. a. Define Genetic Progress.

b. Herd average Weaning weight = 150kg
Selected Heifers weaning weight = 275kg
Selected bulls weaning weight = 500kg
Heritability of weaning weight = 0.3

i. What is selection differential for heifers?

ii. What is selection differential for bulls?

How many kg of genetic progress would you expect

iii. If the selected heifers were bred to original herd bull?

iv. If the selected heifers were bred to selected bulls?

v. If the selected bulls were bred to original cows?

6. a. Selection is an important tool used in the improvement of farm animals. What are the factors selection depends on for effectiveness?

b. Discuss concisely three methods used when selecting to improve several traits.

END OF EXAMINATION
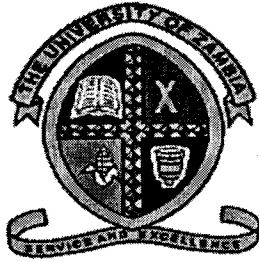
THE UNIVERSITY OF ZAMBIA

FINAL EXAMINATION

COURSE NAME: CROP PROTECTION
COURSE CODE: AGC312
TIME ALLOWED: THREE (3) HOURS
DATE OFFERED: MONDAY 19ᵀᴴ DECEMBER 2005.

INSTRUCTIONS

This paper is comprised of three sections, A, B and C. Answer each section in a **SEPARATE** answer booklet and clearly indicate which section is in which booklet. Answer **ALL** questions. Points for each question are indicated.

SECTION A: PLANT PATHOLOGY.

Q1. 25 points
List ten (10) plant disease symptoms and give one disease example of each and include the scientific name of the causal organism.

Q2. 25 points
Explain the following:-
   a) Disease cycle
   b) Koch's postulates
   c) Integrated disease management
   d) Sample collection for disease diagnosis

SECTION B: WEED SCIENCE.

Q1. 15 points
What are weeds and how do they impact humanity?

Q2. 15 points
Discuss the various weed management strategies.

SECTION C: ENTOMOLOGY

Q1. 20 points
Write brief notes on the following:
1. LD_{50} of chemical insecticides
2. Augmentation as an approach or technique of biological control.

-END OF EXAMINATION-

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCE

SECOND SEMESTER EXAMINATIONS, DECEMBER 2005

AGC 342: PRINCIPLES OF CROP PRODUCTION

TIME ALLOWED: 3 HOURS

INSTRUCTIONS
    (1) Answer five (5) Questions
    (2) Marks as indicated

Question 1 (20 Marks)
  A. Briefly describe:
    (i) Nutrient depletion,
    (ii) Root absorbing power,
    (iii)Three aspects of the electromagnetic spectrum important for plant growth, and
    (iv)Agroforestry.
  B. Explain:
    (i) The difference between Reference and Crop Evapontraspiration.
    (ii) Why plants grow differently in different soils even if they have the same moisture content.

Question 2 (20 Marks)
Name three important plant growth factors important in small-scale agriculture. What measures will you put in place to improve the productivity of this sector in Zambia?

Question 3 (20 Marks)
  i) What method would you use to determine soil moisture content that is quick, non-destructive and measurements can be made in situ.
  ii) Explain the underlying principles for measuring soil moisture with this method.
  iii) What are the advantages and disadvantages of the method?

Question 4 (20 Marks)
  A. What are the mechanisms important in plant nutrient uptake?
  B. i) Describe indigenous sources of plant nutrients you know are found in Zambia.
    ii) Briefly explain the requirements for essentiality in plant nutrients.
  C. i) Which of these elements C, H, O, N, P, S, K, Ca, Mg, Fe, Cu, Zn and Mo are micronutrients.
    ii) Describe the role of two of the micronutrients.
  D. How do you interpret hunger signs in crops?

Question 5 (20 Marks)

A   i) What is photosynthesis?

      ii) What factors affect photosynthesis?

      iii) What is the importance of this process to life on earth?

      iv) How is 85 to 90% of the dry matter of plants related to photosynthesis?

B. Briefly describe: C_3 and C_4 plants.

Question 6 (20 Marks)

A. What role has Developmental Physiology played in elucidating the mechanisms of plant growth?

B. What are the three aspects of plant development?

C. i) What plant substances play a role in coordinating plant growth and development?

      ii) Name at least three of these substances and the role they play.

Question 7 (20 Marks)

The families Gramineae, Leguminosae and Malvaceae constitute important crops in the economy of Zambia:

    i) List two members of each family,

    ii) Give their scientific names, and

    iii) Describe their economic importance.

END OF EXAM
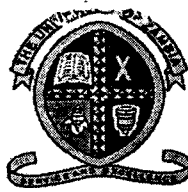
COURSE: AGC 422 HORTICULTURAL SCIENCE 1
TIME ALLOWED: Three (3) hours.
INSTRUCTIONS: 1. Answer all Questions.
2. Marks are as Indicated on the Question Paper.

Q1. A farmer would like to grow Amaranthus for the first time. As an Agricultural Officer, prepare production recommendations for the crop. **(25 marks)**

Q2. As a supplier of seedlings, which method of propagation would you employ to raise new mango seedlings from an established tree? Discuss this method in detail giving examples where it is applicable with other fruit species.
(25 marks)

Q3. A farmer is suspecting the following in his orchard(s) and field:

a. Ivy scales.
b. Purple blotch.
c. Guava blister.

As a pathologist, give a description of the disease/pest, crop(s) attacked, causal organism and conducive environment for development (where applicable), symptoms and preventive/control measures that need to be undertaken.
(20 marks)

Q4. As a horticultural expert, you have been approached by a retiree who would like to set up an orchard. Advise on the factors to be considered when setting up an orchard. **(20 marks)**

Q5. Juvenility is one of the processes that determine when plants flower with respect to season. Explain the process in detail. **(10 marks)**

End of Exam
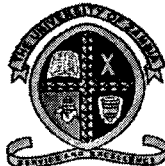
THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY EXAMINATIONS – DECEMBER 2005

AGC 442 PLANT BREEDING 1

TIME: THREE HOURS
DATE: DECEMBER 05 2005
ANSWER: FIVE questions only. All questions carry equal marks.

MARKS

1.0 Write short notes on the following   **(20 Marks)**
   a) Pure line theory
   b) Selection differential and selection intensity
   c) Early generation tests for yield
   d) Merits and demerits of pedigree selection
   e) What would be the progenies of the following crosses when there is incompatibility in plants:

     i. $S_1S_2 \times S_1S_2$
     ii. $S_1S_2 \times S_1S_3$
     iii. $S_1S_2 \times S_3S4$

ANSWER _EITHER_ QUESTION 2 OR 3
(20 Marks)

2.0 Plant Physiologists have established that Abscisic Acid (ABA) is a drought signal in plants. This hormone is produced in the roots at the onset of water stress. It is transported via the xylem from roots to the leaves and detected by stomatal guard cells which effect stomatal adjustment (or closure of the stomata) to reduce moisture loss from the plant through transpiration. This acid acts as a signal from the roots to alert the rest of the plant, that there is danger of drought looming on the horizon for the plant to prepare itself by reducing moisture loss through closure of the stomata. A drought tolerant plant will rapidly produce more abscisic acid in response to moisture stress and thereby conserve water by closing the stomata.

Plant physiologists have developed a rapid non-destructive invivo ABA assay method for cultivated crops which involves collecting plant sap from the xylem cells at the base of the stem of a plant using a syringe under suction pressure and quickly analyzing the sap for concentration of ABA.

You have just been appointed Maize Breeder by the new Seed Company Bio Source Ltd. to develop **OPV** and **hybrid** maize varieties that will have **high yield potential** and **drought tolerance** for Zambia using Abscisic Acid production.

1

Clearly and comprehensively elaborate your Breeding Programme to develop OPV and Hybrid maize varieties with drought tolerance and high yield potential.

(20 Marks)

3.0 The horticulture industry has just learnt of a huge export market for Sun-Dried tomatoes in China. As a way of reducing the trade imbalance between Zambia and China, the Chinese Government has given Zambian farmers an annual Quota allocation to export **2 million tons** of Sun-dried tomatoes to the Chinese Culinary Industry. The Zambia Government, through its exuberantly enthusiastic Minister of Agriculture, has assured the Chinese Government that it will rise to the Challenge to meet the order.

To achieve this, the Government has decided to work through the private sector to drive this industry through out grower schemes using thousands of small scale farmers. The Governments involvement is to ensure good marketing channels and also that tomato production is done according to Good Agricultural Practices (GAP) for Quality Assurance.

However Economic analysis has shown that the cost of "D" Compound fertilizer, (Applied at a rate of 16 x 50 kg bags per ha) reduces profitability of Sun-Dried tomato production. Economists have recommended that plant breeders quickly develop tomato varieties that can utilize rock phosphate which is plenty in the country to cut down the use of "D" Compound to reduce cost of production.

Some reports in journals have indicated that there exists variation in Rock Phosphate Uptake (RPU) among tomato cultivars. The mechanism of this trait is that, plants with good RPU efficiency exude an acid from the roots into the soil moisture in the root zone which dissolves the phosphate and makes it available to the plant. The more acid exuded the more efficient the plant is in RPU. Plant physiologists have already developed rapid and inexpensive non-destructive root exudates screening methods for RPU in tomatoes.

Supposing you have been given the task of developing **High Yielding** and **RPU** efficient tomato varieties which will use the locally available rock phosphate deposits in Zambia, how you would quickly respond to the urgent market needs for this type of tomato varieties. **Clearly and comprehensively explain your tomato improvement programme.**

(20 Marks)

4.0 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

a) Calculate the frequency of the alleles O_2 and o_2 in the above population.

2

b) Was the population in H-Weinberg equilibrium?

c) Does the OPV comprise of enough High lysine (QPM) to make a difference in the nutrition of the people consuming this maize?

(20 Marks)

5.0 List four population improvement methods used in breeding cross pollinated crops and clearly discuss one of the methods in detail.

(20 Marks)

6.0 a) Biotechnology has great potential application in crop improvement. Briefly discuss some of the possible application of tissue culture techniques in crop improvement

b) There has been good crop improvement research work in Crop Science Department on grain legumes. Discuss the objectives of the Breeding Programme, the Breeding Methods that were used in this work and achievements so far.

(20 Marks)

7.0 Discuss how hybrid sorghum varieties are developed and how certified hybrid sorghum seed for farmers is produced.

---------------------------END OF EXAMINATION.   MERRY X – MAS-------------------

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF CROP SCIENCE

FINAL EXAMINATION

AGC 542-INTEGRATED PEST MANAGEMENT **DECEMBER 2005**

TIME: 2^1/2 HOURS

Instructions:
i.   **Answer all questions**
ii. **All questions carry equal marks**

1. Pests may be assessed directly or indirectly. Discuss direct assessment of pests in the environment.

2. Compare binomial sampling with enumerative sampling of pests and outline the components of a good sampling scheme for insect pests.

3. Differentiate between "natural control" and "biological control". Discuss the advantages and limitations of biological control in pest management programmes.

4. Discuss the steps involved in the implementation of importation and colonization as a method of biological control.

5. Differentiate between a solitary parasitoid and a gregarious parasitoid. Discuss the factors that make a natural enemy a successful biological control agent.

**************************END OF EXAMINATION************************
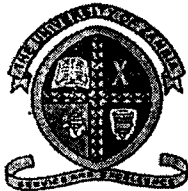
COURSE NAME: SEED TECHNOLOGY
COURSE CODE: AGC562
TIME ALLOWED: THREE (3) HOURS
DATE OFFERED: MONDAY 19TH DECEMBER 2005

INSTRUCTIONS

Answer question 1 as it is compulsory and any other three questions. Points for each question are indicated.

COMPULSORY

Q1. 40 points

a) Define the following terms

   i)   · Pure seed
   ii)   Germination
   iii)   Apomixis
   iv)   Population
   v)   Variety denomination

b) Discuss the considerations that a breeding program must address in a seed program.

c) What is DUS and what is its importance in seed technology?

d) Discuss the basic elements of a seed market.

e) In Seed Legislation, differentiate between the Act and the Regulations.

OPTIONAL, ANSWER ONLY THREE QUESTIONS

Q2. 20 points

a) Define seed vigor and discuss what factors influence it.

b) What is seed certification and what are its components?

Q3. 20 points

a) Discuss seed dormancy and the methods of breaking it.

b) Discuss the various modes of infection of seed-borne diseases and the damage they cause.

Q4. 20 points

a) Discuss the compositions and functions of the variety release committee and the different types of variety lists.

b) Why are seeds processed and on what basis are they processed?

Q5. 20 points

a) Discuss seed storage needs of various components of the seed industry.

b) Differentiate between hypogeal and epigeal germination and discuss the pattern of seed germination.

END OF EXAMINATION!!!
BON VOYAGE.

THE UNIVERSITY OF ZAMBIA

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2005 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGE 222:   FUNDAMENTALS OF MACROECONOMICS

TIME: THREE (3) HOURS

ANSWER ALL QUESTIONS IN SECTION A AND CHOOSE THREE (3) QUESTIONS
IN SECTION B

SECTION A: ANSWER ALL QUESTIONS. Please circle or tick the correct answer. Each
question carries 2 marks.

1)   If machines did not depreciate, net national product

   a)   Would be the same as the capital consumption allowance
   b)   Would equal national income except for the statistical discrepancy
   c)   Would equal GNP
   d)   None of the above is true

2)   Pick the correct statement

   a)   NNP = GNP – Capital consumption allowance
   b)   Disposable income = Personal income – Personal income taxes
   c)   Personal income can be smaller than disposable income if transfer
        payments are large enough
   d)   NNP = National income + indirect business taxes + statistical discrepancy

3)   Which of the following does not affect consumption?

   a)   Disposable income
   b)   Past accumulation of saving
   c)   Whether income is expected or unexpected
   d)   All of the above affect consumption

4)   The graph relating consumption and disposable income is:

   a)   Unaffected by changes in taxes
   b)   Unaffected by changes in people's thriftiness
   c)   Affected by an increase in national income even when disposable income
        does not change

5) Beginning from an equilibrium position, a lowering of the level of government spending would cause the level of:

a) Aggregate demand to increase
b) Aggregate demand to decrease
c) Aggregate supply to increase
d) Aggregate supply to decrease
e) Both aggregate demand and aggregate supply to decrease

6) If MPC is a constant at a value of 0.5 and autonomous consumption is K100, then when national income is at K1000, consumption spending is:

a) K500
b) K2100
c) K600
d) K800

7) If the MPC = 0.75,

a) The simple multiplier is 4.0
b) The balanced budget multiplier is 1.0
c) The net tax multiplier is 3.0
d) Choices a and b are correct
e) All of the above

8) 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 the 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

9) The opportunity cost of holding money if holding bonds is the next best alternative is:

a) The loss of liquidity by holding money instead of bonds
b) The interest income one earns on bonds
c) The loss in money's purchasing power through inflation
d) All of the above

10) If the required reserve ratio was 20%, and bank reserves were increased by K100, then money supplied could

a) Increase by as much as K20
b) Increase by as much as K100
c) Increase by as much as K500
d) None of the above, the money supply would decrease

11) 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

12) Growth of wealth, other things equal would tend to cause an increase in

a) Bond prices
b) The portfolios of the population
c) Speculative demand for money
d) Transactions demand for money
e) All of the above

13) 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

14) The flatter the slope of the money demand curve and the steeper the slope of the planned investment curve

a) The more effective monetary policy will be
b) The larger is the crowding out effect
c) The more effective fiscal policy will be
d) The slopes mentioned above make neither monetary policy nor fiscal policy especially effective.

15) 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

16) A person who was laid off and expecting to be recalled soon would be;

a) Underemployed
b) Employed
c) Unemployed
d) Out of the labour force
e) Institutionalized

17) Which of the following people would be officially considered unemployed?

a) People who look for new jobs when on leave
b) People who work part-time to help pay the bills while looking for a full-time job
c) People who are not working and who have made no effort to find a job
d) All of the above
e) None of the above

18) An increase in expected inflation causes

a) The Phillips curve to shift up
b) The Phillips curve to shift down
c) The Phillips curve to become vertical
d) No change in the Phillips curve

19) The basis of international trade is that countries have:

a) Similar patterns of demand
b) Different economic systems
c) Similar balance of payments positions
d) Different endowments of factors of production

20) What effects will the imposition of a tariff have on prices and production in the country imposing the tariff?

	Prices	Production
a)	raised	raised
b)	raised	lower
c)	lower	lower
d)	lower	raised

SECTION B: ANSWER THREE (3) QUESTIONS FROM THIS SECTION. Questions 1 and 2 are compulsory. Each question carries 20 marks.

1. Given the following economic system:

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

    $C = 50 + .75 \, Yd$ (Consumption function)
    $T = 10 + .2 \, Y$ (Tax function)
    $G = 70$ (Government expenditure)
    $I = 60 - 50 \, i$ (investment function)
    $X = 40$ (Exports)
    $M = 10 + .4 \, Y$ (Imports)
    $Yf = 500$ (Full employment output)

    (a) Derive the equilibrium equation for Y
    (b) If i = .10, what is the level of Y?
    (c) What is the state of the government budget?
    (d) Is the government pursuing an expansionary or contractionary policy? Explain
    (e) What is the value of the multiplier in this economy?

2. For each of the following statements say whether you agree or disagree and explain your answer.

    (a) During periods of budget surplus (when G<T) the government debt grows.
    (b) A tax cut will increase the equilibrium level of GDP if the budget is in deficit but will decrease the equilibrium level of GDP if the budget is in surplus.
    (c) If the MPS = .90, the tax multiplier is actually larger than the expenditure multiplier.
    (d) The demand for money is the same thing as aggregate demand because it takes money to buy anything.

3. (a) When is the fiscal policy completely ineffective and when is it very effective? Explain using the IS – LM curves.
    (b) Explain what you understand by an expansionary monetary policy.
    (c) What is the major cause of the crowding out effect in an economy?
    (d) Why might investment not respond positively to low interest rate during a recession?

4. Explain what you understand by the following concepts:

    (a)   Nominal exchange rate
    (b)   Phillips curve
    (c)   Comparative advantage
    (d)   Contractionary fiscal policy
    (e)   Liquidity trap

5. With the aid of a diagram, show the effects of a tariff on the domestic market. Identify the consumer surplus, producer surplus and government revenue. What is the effect of a tariff on domestic supply and level of imports after tariff is introduced?

UNIVERSITY OF ZAMBIA
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2005 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS
AGE 452: INTERMEDIATE AGRIBUSINESS MANAGEMENT
TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER **FIVE** QUESTIONS ONLY. QUESTION **ONE** IS COMPULSORY. ALL QUESTIONS CARRY EQUAL MARKS.

1. Planning is necessary for any Agribusiness to succeed; yet often business owners do not often devote enough time and energy to it. Recent research suggests that one of the major reasons for business failure is poor management, which is attributed to failure to plan effectively.
   a) In what ways do you think an Agribusiness owner benefits from developing a business plan? **(9 marks)**
   b) What will the bank /loan official(s) be looking for in your business plan? **(3 marks)**
   c) Suggest some outline headings for a business plan for expansion of an Animal feed processing plant **(8 marks)**

2. Entrepreneurship and small business development are important and vital activities in the socio-economic development of all countries and societies. Entrepreneurship is for everyone. No matter what job or position one occupies, there is need to cultivate entrepreneurial characteristics.

   a) Discuss the motives and challenges of starting and running a new business **(13 marks)**
   b) Discuss the building blocks of successful entrepreneurship **(7 marks)**.

3. Discuss the forces influencing competition in the Agribusiness Industry and how they may be manipulated to capture the Zambian broiler market **(20 marks)**.

4. i)   Explain the term generic strategies **(2 marks)**
   ii) Distinguish between the following pairs of strategies:-
        a)   Conglomerate diversification and Concentric diversification **(4 marks)**
        b)   Product development and Innovation **(4 marks)**
   iii) Explain the role of SWOT analysis as a tool for facilitating strategic choice **(5 marks)**
   iv) What are the risks involved in choosing a cost focus strategy rather than a differentiation strategy in order to gain competitive advantage **(5 marks)**

5. You are a District Agricultural Coordinator and have been invited by Zambia Export Growers Association to give a speech to Alpha Cooperatives (One of its affiliates). The Cooperative comprises small-scale farmers who produce vegetables for export. The purpose of the visit is to give a speech on the *Role of Supply Chain management in promoting competitiveness in the domestic and International markets.*
Prepare your speech notes highlighting:
   a) The definition of Supply Chain Management **(2 marks)**
   b) Trends in the agricultural/food market system necessitating small farmer organizations/Agribusinesses to embrace the Supply chain management concept **(6 marks)**
   c) The drivers of the changes in (b) above **(6 marks)**
   d) Benefits of Supply chain management **(6 marks)**

6. a) Briefly discuss the seven sources of innovative opportunity as highlighted by Peter Drucker **(5 marks)**
    b) Briefly discuss the five forms of governance structures an agribusiness may choose from **(5 marks)**
    c) Explain the role of the Boston Group of Companies matrix as a tool in Strategic Choice **(5 marks)**
    d) Explain the difference between Product differentiation and Market segmentation **(5 marks)**

END OF EXAM

UNIVERSITY OF ZAMBIA

2005 ACADEMIC YEAR SECOND SEMESTSTER EXAMINATION

AGE 552:   AGRICULTURAL EXTENSION EDUCATION

TIME: THREE HOURS

ANSWER: FIVE QUESTIONS.
           ALL QUESTIONS CARRY EQUAL MARKS (i.e.20)

QUESTIONS

1. Communication is the basic precondition of any extension intervention.
    a. Define the word communication.
    b. With an aid of a diagram explain the principal segments and main influencing factors that you would consider in order to improve the effectiveness of your communication.

2. An Extension intervention induces "voluntary behavior". In the light of the most fundamental and practical key features of the Participatory Extension Approach, comment on how such behavior might be induced.

3. Critically examine the theoretical basis for the introduction of the Training and Visit System of agricultural extension in Zambia. Mention any four of the advantages and disadvantages associated with the approach.

4. Outline and briefly explain the successive steps of the adoption process. State at least two characteristics of each of the ideal adopter categories suggested by Everett Rogers.

5. Define the concept of adaptive research and explain the steps involved in conducting such a research.

6. Fully explain the five aspects of organization theory that would help you improve the design and operational efficiency of an extension service you have studied.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2005 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGE 562 INTERMEDIATE FARM MANAGEMENT

TIME: THREE (3) HOURS
INSTRUCTIONS:
Answer <u>all</u> five (5) questions

Q1   **a)** Agricultural Labor has unique characteristics that affect its use   and
management on farms. What are these characteristics? **(5 Marks)**

b) Discuss the factors to be considered in assessing the farm's labor needs
and planning the farm's labor resources.   **(10 Marks)**

c) Why is it necessary to include a training program for a new farm employee?
(5 Marks)

Q2   **a)** Why is land an important resource in farming? **(4 Marks)**

b) State three advantages and three disadvantages of leasing land? **(6 Marks)**

c) Using the Income Capitalization method of valuation and a 9% discount rate,
how much could you afford to pay for a hectare of land that is expected to have
a net return of K800, 000/ year **(2 Marks)**

d) i) What is the importance of a financial feasibility analysis in any capital asset
(including land) purchase decision? **(2 Marks)**

ii) Outline alternatives to be undertaken, given a negative cash flow in the first
few years of the investment after a financial feasibility analysis. **(5 Marks)**

Q3   Mr. Mubiana a farmer in Kalabo intends to secure a K30 million loan from
ZANACO bank for the expansion of his piggery enterprise. The loan is to be
repaid in 6 years under an amortized equal total payment plan with a 10 % interest.

a) What is the total payment Mr. Mubiana would have made at the end
of the repayment period? Develop a table showing the amount of interest,
principle and total payment for each of the repayment years **(8 Marks)**

b) What Important factors should Mr. Mubiana consider in the expansion of his Piggery enterprise? **(12 Marks)**

Q4   **a)** Give at least five (5) reasons why a farmer would consider replacing his machinery on the farm. **(5 Marks)**

b) Mr. Mulenga plans to purchase a tractor and has two alternatives. He can either buy a brand new tractor at K150 Million or he can buy a used one from Mr.Banda at K 80 million. The new tractor has a useful life of 8 years, while the old tractor has a 5 year- useful life. The Present Value of the Net Cash flows amounts to K75 million and K65 million for the new and the old tractor respectively. Assuming the weighted average cost of capital is 12 %, determine the most profitable alternative using the NPV criteria **(10 Marks)**

c) i. What is the Field capacity in acres per hour for a 24 foot wide Tandem disk operated at 5 miles /hr with 75 % Field Efficiency? **(2 Marks)**

ii. How much time would be saved if the Field efficiency could be increased to 90% on 600 acres of land? **(3 Marks)**

Q5   **a)** What is the difference between data and information and why is this difference important in setting up a Control System? **(5 Marks)**

b) The "Equal Marginal Return Principle" is of little use in developing a Management Information System for an Enterprise Control system. Do you agree or disagree with this statement? Give reasons for your answer **(5 marks)**

c) What is the most important key component of a typical Financial Control System and why is it the most important? **(5 Marks)**

d) What is the importance of the historical product and input market prices in the Market Control System? **(5Marks)**

END OF EXAMINATION!

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2005 ACADEMIC YEAR SECOND SEMESTER

FINAL EXAMINATIONS

AGE 572: ADVANCED AGRICULTURAL POLICY

TIME: THREE HOURS

INSTRUCTIONS: Answer all questions

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1. The government officially launched the National Agricultural Policy document in October 2004.

   a) Discuss briefly the measures that encompass the long-term vision for the agriculture sector. (10 marks)

   b) Discuss the main attainments (targets) that the government aims to achieve. (10 marks)

2. a) The government wants to ensure that the urban poor can afford a sufficient quantity of a basic food crop through a pricing policy. Discuss and illustrate by a demand and supply curves diagram the impact of such a policy regarding:

   - Excess demand
   - Excess supply
   - Equilibrium
   - Consumer surplus
   - Producer surplus (10 marks)

   b) Under autarky country A produces 6 units of pottery and 3 units of grain. Country B produces 9 units of pottery and 12 units of grain. Discuss and illustrate by form of diagram the resultant gains if trade and specialization is adopted. (10 marks)

3. The World Bank's "market friendly" approach to development has noted the importance of institutional and organizational efficiency and thus the need for the government's intervention in the economy. Discuss four developments that have been shown to undermine the interventionist policy. (20 marks)

4. The following PAM was partially constructed for a maize commodity system:

	Revenue	Traded Inputs	Domestic Factors	Profits
Private Prices	8580	3971	4147	
Social Prices	18150	5268	4807	
Transfers	-9570	-1297	-660	

a) Complete the matrix by determining the profits figures for private prices, social prices and transfers. (2 marks)
b) Compute Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC) and Domestic Resource Cost Ratio (DRC) and explain what the incentive indicators you obtain mean. (12 marks)
c) Discuss the methodological issues which have to be considered in the construction of PAM. (6 marks)

5. The level of food insecurity is a major concern in Zambia by the government and other stakeholders.
   a) Define and describe what Food Security means. (4 marks)
   b) Describe and briefly discuss various forms of Food Insecurity. (8 marks)
   c) Discuss the main causes of Food Insecurity. (8 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2005 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGE 582: PROJECT MONITORING AND EVALUATION

TIME: THREE HOURS
INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER FOUR QUESTIONS

1.   (a) Monitoring and Evaluation (M&E) are essential in accomplishing the objectives of projects. Define the terms "Monitoring" and "Evaluation" and comment on the distinction between monitoring and evaluation.
     (b) Elaborate on the purposes of Ongoing, Mid-term, Terminal and Ex-post evaluations.

2.   Explain what a Logical Framework is. Citing appropriate examples, elaborate on the elements of a typical log frame and elucidate on the terms "vertical logic" and "horizontal logic".

3.   You are a Monitoring and Evaluation Officer in a rural development project. Describe the components of a project monitoring system that you would assist in setting up for the project. Cite appropriate examples to explain the purpose and timing in the application of each of these components.

4.   What is a diagnostic monitoring study? Identify and briefly explain on the kinds of data that is collected and analyzed in a typical single-site diagnostic monitoring study.

5.   You have been hired as part of a team of Consultants to conduct an impact evaluation of an agricultural project which was involved in the promotion of cash crop farming and irrigation development among smallholder farmers. Identify and briefly elaborate on the kinds of data you would collect and analyze in an impact evaluation of this agricultural project.

6.   (a) Identify four (5) quantitative tools that are used in data collection in M&E. Explain what these are and outline the advantages and disadvantages associated with these tools.
     (b) Identify (5) qualitative methods of data collection in M&E and briefly explain what they are.

7.   Write brief notes explaining the main differences between the following:
     (a) Cross-site Analysis and Sectoral Analysis
     (b) Project Stakeholders and Project Beneficiaries
     (c) Cross-sectional Studies and Cohort Studies
     (d) Quasi-Experimental Design and Systems Analysis

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2005 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATIONS

AGF 332 METHODS IN FOOD ANALYSIS I PRACTICAL

TIME ALLOWED: THREE HOURS

INSTRUCTIONS

Answer all the questions.

1. Describe how you would use a UV/VIS spectrophotometer or a colorimeter to determine a coloured food complex.

2. A client has brought you a 'top secret' food sample labeled F 01 for the determination of cholesterol content. Study the sample and carry out the following procedure:

   - Pipette 1.0 and 5.0 cm^3 of F 01 in two conical flasks.
   - To the flasks add $20cm^3$ of ethanol-ether mixture (2:1).
   - Mix the contents well and carefully heat to boiling in water.
   - Stir and leave to cool. After standing about 30 minutes,
   - Filter and wash the precipitate, with portions of warm solvent to achieve a filtrate volume of $25cm^3$.
   - Evaporate the filtrate to dryness on a boiling water bath in a fume cupboard; add a little ethanol and re dry.
   - Cool and add $5cm^3$ chloroform, $2cm^3$ acetic anhydride (carefully) and $0.1cm^3$ sulphuric acid (AR).
   - Mix; allow the colour to develop in the dark for exactly 30 minutes.

3. Prepare 5 sets of standards containing 0.2-2mg of cholesterol in $5cm^3$ chloroform. Run the standards and reagent blank as above.

   Read all the tubes at a wavelength of 680nm. Rinse the couvette with a little chloroform between readings. This should be done in fume hood.

4. Prepare a calibration curve with the standard readings.

5. Calculate the cholesterol content per $100cm^3$ of F 01 and write a report to your client

END OF PRACTICAL EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

FOOD TOXICOLOGY (AGF 342) EXAMINATION

Second semester   **December 2005**

Answer 5 questions
Write neat and legible (readable) work.

1. a) Name 2 classes of insecticides. In what way do they affect human beings?   [10]

   b) What are polycyclic aromatic hydrocarbons? Name two.   [10]

2. a) What are saponins.   [5]

   b) What is scombroid poisoning?   [5]

   c) How does *Clostridium Perfringens* cause food infections   [10]

3. a) Give the generalized protocol for the quantitative measurement of toxicants in biological samples.   [10]

   b) The transformation of a cell into a neoplastic cell is considered to proceed through certain phases called carcinogenesis. Describe this process.   [10]

4. a) What are the characteristics of cancer?   [10]

   b) Draw and describe the food safety decision tree.   [10]

5. a) Describe in 5 lines or less

   - NOAEL
   - Hazard
   - Genotoxic
   - Lysinoalanine
   - In vivo tests   [10]

   b) What are the major routes of exposure of a human being to toxicants.   [10]

6. a)   Describe in 5 lines or less

   - ADI
   - Teratogenicity
   - Epigenetic
   - Food safety
   - Aflatoxins   [10]

   b)   What is a food allergen? Give examples.   [10]

7. a)   How are heterocyclic aromatic amines generated in foods? Give examples
        of these compounds.   [10]

   b) What kind of hazards can frying our foods expose us to?   [10]

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

2005 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

NUTRITION AGF 422.

TIME : THREE (3) HOURS

INSTRUCTIONS

ANSWER ALL QUESTIONS FROM SECTION A AND ANY ONE QUESTION FROM SECTION B
EACH QUESTION CARRIES 20 MARKS
ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOKLET

SECTION A

QUESTION 1

a) What types of carbohydrates are used in human nutrition?
b) What are the functions of these carbohydrates in the body?
c) Describe in detail, digestion and absorption of carbohydrates and fibre
d) Why do carbohydrates form the bulk of most human diets?

(20 Marks)

QUESTION 2

Explain in detail, End Stage Renal Disease (ESRD). Causes, consequences and symptoms, and medical management and nutritional management.

(20 Marks)

QUESTION 3

Give and describe the two typical pictures of Protein Energy Malnutrition (PEM) in children of less than 5 years.

(20 Marks)

QUESTION 4

A district in the western province of Zambia was targeted for Dietary Supplementation program for Women of Reproductive Age. Corn/Soya blends (HEPS) were used as the food items in the program.

Women were randomly allocated to a High Energy/High Protein supplement of 160kcal + 12g protein/serving or Low Energy/No Protein supplement of 60kcal + 0 protein/serving. As soon as the women where pregnant, they were entitled to the supplement which was served at the local clinic. Participation was voluntary and pregnant women could take as much supplement as they wanted.

The home diet in the district consisted of Nshima or Rice and Beans, which provided an average 1,500kcal and 40 g protein/day. The average height was 149cm and average non-pregnant weight 47kg (BMI = $21.1kg/m^2$).

At the end of the program, the following data was obtained.

Table 1: Results of the Dietary Program

VARIABLES	RESULTS
Height, cm	149
NP-NL Weight, (kg)	47
NP-NL BMI (kg/m²)	21.1
Home Diet (Kcal)	1,560
Baseline Birthweight (g)	2,950
Baseline % LBW	18
After Supplementation	
Diet, kcal/day	1,800
Birth weight	3,105
%LBW	5

Table 2: Effect of Supplementation on Birth Weight

Birth weight categories	Amount of supplementary calories consumed		
	<5,000	5,000 – 19,999	>20,000
>3,000g	42	42	55
2,600 – 3,000g	38	40	40
<2,500g	20	18	5

Table 3: Percentage LBW after supplementation by Socio-Economic Status

Birth weight categories	Height <147cm		Height >147cm	
	Low Supplementation	High Supplementation	Low Supplementation	High Supplementation
Low	38%	24%	20%	6%
Medium	15%	12%	13%	8%
High	6%	1%	2%	5%

From the data provided, answer and discuss the following;

i) Did energy supplementation have any impact on fetal growth and how?

ii) Was there a difference In impact on birth weight between short and taller mothers and why?

iii) Did the social economic status have any effect on Low Birth Weight?

(20 Marks)

SECTION B

QUESTION 5

Discuss the repercussions of Chronic Energy Deficiency (CED) among women of reproductive age, related to:-
  i.   BMI cut offs
  ii.   Pre-pregnant weight
  iii. Pregnancy and lactation
  iv.   Weight monitoring
(20 Marks)

QUESTION 6

What functions do protein serves in human nutrition? What foods are sources of protein? And briefly describe protein synthesis and the levels of protein structure.

(20 Marks)

QUESTION 7

In brief, explain the functions, food sources, deficiency, and toxicity of the following minerals:-

- Calcium
- Iron
- Selenium

(20 Marks)

GOOD LUCK!!!!

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2005 ACADEMIC YEAR SECOND SEMESTER FINAL

EXAMINATIONS

AGF 452 METHODS IN FOOD ANALYSIS II

TIME ALLOWED: THREE HOURS

INSTRUCTIONS

Answer any **four** questions. Questions carry equal marks.

…………………………………………………………………………………………

1. (a) You need to perform ash analysis on calcium fortified liquid gravy. You know the gravy contains 0.65% calcium, 20% fat, 5% sugar and 15% starch. What precautions would you take when performing dry ash analysis on the gravy sample?

   (b) You want to set up a tomato sauce processing plant. Describe briefly how you would ensure a good product.

   (c) You are a manufacturer of infant formula. You currently determine the protein content of the final product using the Kjeldahl method with a nitrogen conversion factor of 6.21.

      (i) How many grams of nitrogen per 100 grams of protein does the product have?

      (ii) You decide to independently test the nitrogen content of the protein and you find that it has 15.67g of nitrogen per 100g of protein. Is the 6.21 Kjeldahl factor you are currently using correct?

   (c) Explain why extrapolation of a linear calibration curve usually causes increased bias, and degraded precision in instrumental analysis.

2.   (a)   As a part of quality assurance programme you have decided to determine titratable acidity of a rasberry jelly product (this analysis provides an indication of the tartness of your product). What modifications in the standard procedure (titration with 0.1M NaOH to the phenolphthalein end point) would you make for this product?

    (b)   When samples are analyzed by potentiometry, a high impedance Voltmeter is used when measuring the potential difference. The use of this voltmeter ensures that negligible current flows during the measurement. List the reasons why this trait is desirable in Potentiometric measurements.

    (c)   Briefly explain the roles of the working, counter and reference electrode in the potentiostatic electrolytic cell.

    (d)   A calcium ion selective electrode is immersed in a sample at $25^\circ C$ and the potential is measured. Theoretically, what should happen to the signal if the sample were diluted exactly 20-fold?

3.   (a)   Explain in some detail the mechanism by which analyte concentration determines the signal in Voltammetry.

    (b)   Voltammetry was used to determine the zinc content of a breakfast cereal. A 2.314g sample was digested in boiling concentrated nitric acid. After the sample dissolved, it was diluted to 100ml. A 5.00ml portion of this solution was analyzed by differential pulse polarography, giving a current of $2.31\mu A$. when $50.0\mu L$ of 100ppm zinc standard was added to this solution, the current was $2.99\mu A$. what is the concentration of zinc in the cereal?

    (c)   Describe how you would calibrate a pH electrode. What errors are associated with pH measurements?

(d)   An unknown amount of Co^{2+} ions in a food sample produces a faradic current of 12.3µA on a normal pulse voltammogram. After 0.100ml of $1.0x10^{-3}M$ Co^{2+} is added to the original volume of 5.00ml, the new current is 28.2µA. Calculate the original amount of cobalt in the food sample.

4.   (a)   You are performing calcium analysis on a milk sample using AAS. Your results for the blank are high. What could be causing this problem and what is a possible remedy?

(b)   You are performing flame atomic absorption spectroscopy on a milk sample to determine the calcium content. As part of your analysis you determine the amount of calcium in a known standard sample. This allows you to determine the accuracy of your analysis. The value you obtained for the standard is low. Describe four problems that could cause this to occur and how you would correct each problem.

(c)   Sodium benzoate, a salt of benzoic acid (a weak acid), is widely used as a food preservative. You wish to determine the ionization constant of benzoic acid and you choose to use conductometric method for your determination. You find that the equivalent conductance of a 0.002612M benzoic acid solution is found to be 35.25 at 25°C. Calculate the degree of dissociation of benzoic acid at this concentration, and calculate the ionization constant. Given that the Limiting Equivalent conductance of some ions in water at 25°C are:

Cations	λ^0_+	Anions	λ^0_-
H^+	349.8	OH^-	198.6
Na^+	50.1	Benzoate	35.4

(d)   You have a sample of mineral fortified spaghetti sauce. You want to determine the amount of Ca, K, Fe, Zn, Cu and selenium in the sample. What would be the preferred type of atomic spectroscopy to use (justify the type of atomic spectroscopy you select).

3

5. (a) Solute is transported to an electrode by diffusion, convection and electrostatic attraction. In polarography, we want the current to be limited by diffusion. Explain how convective and electrostatic attraction are mininmized.

(b) The determination of riboflavin in vitamin formulations can be carried out polarographically because it is more easily reduced than other vitamin B factors. A 250.1 mg vitamin tablet is dissolved to form a 100.00ml solution. a 10.0ml aliquot of this solution was added to a 0.1M phosphate supporting electrolyte at pH 7.2 and diluted to 50ml. The diffusion limited current was 0.28 µA. a 50.0ml standard 4.10ppm riboflavin solution in the same electrolyte gave a diffusion limited current of 0.45µA. calculate the riboflavin concentration in the diet supplement.

(c) Distinguish between X-ray fluorescence and X-ray absorption measurements. Calculate the wavelength limit for an x-ray operated at 30kV

(d) (i) Briefly describe the principle behind electron spectroscopy for chemical analysis (ESCA).

(ii) You need to use image analysis for online evaluation of hamburger buns. Describe the components of the system you would use and the critical parameters.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

TECHNOLOGY OF MEAT AND FISH PRODUCTS (AGF 512) EXAMINATION

Second semester   6TH **December 2005**

INSTRUCTIONS
Answer any 3 questions from section A and any three questions from section B.
Answer the two sections in separate answer booklets
Write legible (readable) and very neat work.

Section A

1. Salt is an additive with the longest history of use and it has a great number of roles. <u>Briefly</u> discuss four (4) roles or functions of salt (NaCl).

2. Explain the importance of lactic acid production in dry sausage fermentation including its antagonistic effects.

3. Compare and contrast cold shortening and thaw rigor.

4. Briefly explain the following concepts in less than 5 lines
    (a) Nitrosohaemochrome
    (b) Tropomyosin
    (c) Desmosine
    (d) Restructured meat products

Section B

1. a) What are the sensory methods used to assess the quality of fish?   [7.5]
   b) Give a detailed explanation on the freezing process and give its advantages
      and disadvantages as a method of preserving fish.   [12.5]

2. a) How does smoking preserve fish?   [5]
   b) A fish undergoes several changes postmortem. Apart from autolytic changes,
      discuss all the other changes that occur.   [15]

3. a) Define in 5 lines
      - chilled sea water
      - freezer burn
      - F_0
      - pickle
      - TMAO   [5]

   b) What are the factors that affect the growth of microorganisms in fish. Give a
      detailed discussion.   [15]

4. a) Discuss in 5 lines
      - z value
      - MAP
      - cryogenic freezing
      - IQF
      - TMAO   [5]

   b) Frozen fish has a certain shelf life within which it will have satisfactory quality.
      What are the factors that limit its storage?   [15]

UNIVERSITY OF ZAMBIA
SECOND SEMESTER

AGS222 FINAL EXAMINATION

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 answer. (**12 marks**) (**Note**: *2.5 for correct answer*, 0 *for I don't know*, and *-1, for wrong answer*).

    a)   Soil always moves from a region with higher moisture content to a region with lower moisture content.

    b)   Compound D fertilizer which contains 10 % N, 20 % P_2O_5 and 10 % K_2O, contains more Phosphorus than Nitrogen

    c)   A soil containing 2 % organic matter and 20 % clay composed of kaolinite only, has a CEC at pH 7.0 greater than 15 meq/100 grams.

    d) The neutron moisture content is also used to measure the bulk density of the soil.

    e)   At soil with a moist colour of 10 YR 4/6 is lighter than a soil with a moist colour of 10 YR 3/2.

    f)   The matric, gravitational, and osmotic potential are the main components of the" Total Water Potential" of a saturated soil.

2.
    a)   Describe how the water content of the soil is measured using the Gamma Ray Attenuation method, and the Neutron moisture meter. (8 marks)

    b)   List any 3 macronutrients and 3 micronutrients and indicate the chemical forms in which they are taken up by plants. (6 marks)

    c)   Describe three mechanisms by which nutrients in the soil reach the surfaces of plant roots. (6 marks)

    (20 marks)

3. Define the following terms **(10 marks)**

   a) Macro nutrient

   b) Diffuse Double layer

   c) Effective cation exchange capacity

   d) Phosphorus fixation

   e) pF curve

4 The data below was obtained from reading of gravimetric moisture content of two layers of a soil. **(20 marks)**

Soil depth	ρb (g/cm³)	Weight of soil and container wet sample O.D sample		weight of can
		---------------- Grams------------------------------		
0 – 40 cm	1.2	160	150	50
60 - 100 cm	1.5	145	130	50

   i)   Calculate the gravimetric and volumetric moisture contents of the two soil layers (4 marks)

   ii) The equation for calibration curve of the neutron moisture meter for the soil is Y = 0.00125X- 15, where X is the meter reading in counts per minute and Y is the gravimetric moisture content in %. What would be the readings of the neutron moisture meter for the top layer and lower layer of this soil? (5 marks).

   iii) If the neutron moisture meter reading for the top soil later at field capacity is 30, 000 counts per minute, what is the volumetric moisture content of the top layer at field capacity? (5 marks)

   iv) To what depth will the top be wetted after applying 15 mm of irrigation water? (6 marks)

5   A soil which is homogeneous both vertically and horizontally is cropped with tomatoes. The owner of the crop installs three tensiometers at three locations at different depths as presented below: **(13 marks)**

Location	soil depth (cm)(z)	Tensiometer reading (h) (suction in cm)
A	30	1153
B	60	1068
C	90	1034

Based on the information above answer the following:
   a) Calculate the hydraulic heads (H) at each location. (3 marks)
   b) Express the matric potential of each point in terms pF. (3 marks)
   c) Is the soil water moving up or down between points A and B? Give reasons to justify your answer. (3 marks)
   d) What is the matric potential of the soil at 90cm depth in bars and Joules/kg. ? (4 marks)

6   A soil from a prospective farmer's field in Solwezi has the following selected physical and chemical properties. **(25 marks)**

Depth	pH (CaCl$_2$)	ρb g/cm^{-3}	Available P g/ kg soil	Ca	Mg	Na	K	Al	H	CEC$_{8.2}$	Org C %
				---------------cmol/kg soil ----------							
0 -16	4.8	1.36	5.4	0.5	0.5	0.1	0.1	0.3	0.1	6.6	1.3

Answer the following questions.

i)   What is the Effective CEC of this soil? (2.5 marks)

ii)   Express the active acidity of this soil in meq/ liter of soil solution. (2.5 marks)

iii)   The farmer wants to grow an export crop that requires 70 kg potassium per hectare for good yields. Will a hectare of this soil layer be able to supply adequate amounts to meet the requirements of this crop? Show calculations to support your answer. (5 marks)

iv)   If the crop that the farmer wants to grow requires 60 kg of P per hectare, how much Superphosphate fertilizer should be applied to soil, in order to supply the crop with adequate P? Superphosphate fertilizer contains 24 % P$_2$O$_5$. (7. 0 marks)

v)   How much lime will the farmer need to apply to the soil to neutralize all the exchangeable acidity in the 1 hectare of this if the available liming material has a Neutralizing value of 86 %? (Don't use any factor in this calculation). (7.5 marks)

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY SECOND SEMESTER EXAMINATIONS-DECEMBER 2005

AGS 322: SOIL PHYSICS

Time: Three (3) Hours   **Total Marks:** 95
Instruction: Answer all Questions

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1. Briefly define each of the following terms: *[15 marks]*

   a) pF scale
   b) Soil air capacity
   c) Damping depth
   d) Sorptivity
   e) Tortuosity

2. The value of soil temperature at any moment and the manner with which it varies in time and space is an important factor determining the rate and direction of physical, chemical and biological processes in the soil: *[15marks]*

   a) Define the thermal properties that determine the temperature regime of the soil
   b) Give three reasons why moist soils are cooler than dry soils

3. With aid of a diagram, show all the water potential components of a miniature water cycle using a maize plant as the water pump   *[15marks]*

4. A soil profile in a rice field consists of an upper layer of 60 cm and a lower layer of 20cm with hydraulic conductivities of 2.7×10^{-4} cm s^{-1} and 4.5×10^{-5} cm s^{-1}, respectively. If the water depth on the field is maintained constantly above the soil surface and the water discharge (Q) at the bottom layer of the soil profile is 1.2 cm³ min⁻¹ from a surface area of 20 cm²: *[25 marks]*

   a) Determine the amount of water required to maintain a constant water head at the soil surface in (*i*) *mm day'* and (*ii*) *m³ ha' day'*
   b) Determine the height of water on the soil surface required to maintain this constant water discharge above
   c) Determine the soil water potentials (z, h and H) at (*i*) the bottom, (*ii*) interface between the two layers, (*iii*) interface with water and (*iv*) at the water surface
   d) Draw soil water potential (z, h and H) diagram

Continued next page...

5. A farmer in the Mkushi Farming Block settled on a 250 hectare farm. On one site 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 (cm)	Soil Temperature ($^\circ$C)	CO_2 Concentration (g cm^{-3})	Bulk Density (g cm^{-3})
0 – 5	25	0.035	1.50
5 – 20	22	0.030	1.50
20 – 60	20	0.025	1.54
60 – 120	17	0.018	1.53

Assume a particle density of 2.65 g cm^{-3}

Using the measured data above, calculate:

a) The air-filled porosity for each depth (%)
b) The volumetric water content for each depth (cm^3 cm^{-3})
c) The amount of water stored in the soil profile (m^3 ha^{-1})
d) The total heat capacity of the soil profile on volumetric basis (MJ m^{-3} $^\circ$C^{-1})
e) Calculate the quantity of heat (Q_j) stored in the soil per unit area of the profile if the temperature increases by 5 degrees throughout the profile (MJ m^{-2})

End of Exam

THE UNIVERSITY OF ZAMBIA
SECOND SEMESTER EXAMINATIONS
DECEMBER 16, 2005
AGS422
SOIL MICROBIOLOGY

TIME: 3 HOURS
INSTRUCTIONS: Answer all Questions   **Marks: 100**

1.   Define the following terms: (10 marks)

    a. Undefined Media
    b. Immobilization
    c. Nitrogenase
    d. Zymogenous bacteria
    e. Fulvic acids
    f. Chemoorganotroph
    g. Carbon assimilation efficiency
    h. Assimilatory nitrate reduction
    i. Biological nitrogen fixation
    j. Greenhouse gases

2.   Compare and Contrast the following: (15 marks)

    a. Fungi and Actinomycetes in terms of their morphology and cellular organization.

    b. Anaerobic respiration and fermentation.

    c. Symbiotic and Non symbiotic Nitrogen Fixation.

    d. Principles employed in operations of Scanning Electron Microscope and Transmission electron microscope.

    e. Streak Plate Method and Spread Plate Methods of inoculation

3.   Answer the following questions, briefly and concisely   (20 marks)

    a. Discuss the evolutionary relationship between the kingdoms to which soil various soil microorganisms belong.(5 marks)

    b. Describe the stages of decomposition of organic matter and the transformations that take place to the organic materials as the organic matter is decomposed in the soil? (7. 5 marks)

c. Discuss the role microorganisms play in the supply of nitrogen to crops in cultivated fields, and give examples of specific microbes involved in making nitrogen available to plants. (7.5 marks)

4 You have been employed as the manager responsible for agronomic practices at an Export Oriented farm producing "ecological friendly crops". Your responsibility is to ensure that there is minimal pollution of the air, groundwater and surrounding surface water bodies (lakes, rivers and streams) from your farm. What agronomic measures would you adopt to minimize loses of nitrogen from your cultivated fields on farm to the mentioned environments? (10 marks).

5 The growth of a bacterial culture isolated from a soil is given below:

Time (hours)	Number of viable cells
0	14
1	15
2	16
5	23
10	405
12	555
15	555
20	555
30	555
35	230
45	35

Answer the following questions:

a) Plot the growth curve for bacterial culture and label the different portions of the growth curve on the graph paper you have been given and describe the activities taking place during each phase (7.5 marks)

b) Calculate the growth rate and generation time for this bacterial culture. (5 marks)

c) If a suspension of bacterial extract, obtained from a 1 gram sample of soil using 100ml of distilled water and diluted 10^6 times contains 555 bacterial cells, per litre. How viable bacterial cells are present in one kilogram of this soil? (7.5 marks)

6   A soil with 3.0 % organic matter, a bulk density of 1.45 $g.cm^{-3}$, total nitrogen content of 0.04 %, has a cultivated layer 24 cm deep. Answer the following questions related to this soil:

a) Do you expect nitrogen to be mineralized from this soil when decomposition of organic matter begins? Give reason to support your answer   (5 marks)

b) How much carbon should be lost per 100 grams of soil before mineralization of nitrogen occurs? (5 marks)

c) If the average rate of microbial respiration is 48 mg CO_2 /100g soil per day, after how many days from the first day of decomposition will the mineralization of nitrogen start. (5 marks)

d) If the above microbial respiration rate is due to soil microbes with a C/N ratio of 20: 1 and a carbon assimilation efficiency of 75 %:

  i.   Calculate the total amount of organic matter (assimilated and lost) decomposed by microbes in 6 months in 1 hectare of this soil (5 marks)

  ii.   How much nitrogen will be assimilated by microbes in one month per hectare of this soil? (5 marks).

Note: 1 year = 365 days

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMISTER EXAMINATIONS – DECEMBER 2005

AGS 452
PRINCIPLES OF LAND HUSBANDRY

TIME: 3 Hours   Marks: 90

INSTRUCTIONS: **ANSWER ALL QUESTIONS AND WRITE LEGIBLY**

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1.   a) What are soil voids? [2 Marks]

      b) How does the loss of soil voids take place?   [3 Marks]

2.   What would be the best way of using land in a semi-arid region? Give reasons to support your answer.   [6 Marks]

3.   a) Why is it important to understand household circumstances before dealing with land husbandry issues?   [4 Marks]

4.   Why are farm household goals and household structure important when dealing with land husbandry issues?   [4Marks]

5.   Discuss why the following are known to be key features of land:

      a. Climate
      b. Relief
      c. Soils
      d. Organisms and organic matter
      e. Hydrological regime
      f. Vegetation
      g. Past and present human activity   [20 Marks]

6.   a) What are the four (4) ways in which one may alter land-related constraints? Explain each one of the different ways. [8 Marks]

      b) Discuss the nature of acidification as a constraint to sustainable land production and how you would alleviate it.   [10 Marks]

7.   Discuss the importance of the following in the development and promotion of good land husbandry practice:

      a. vegetation
      b. livestock   [10 Marks]

8. Discuss why crops in home gardens yield better than those under field conditions. [5 marks]

9. Explain Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) [8 Marks]

10. What is controlled burning and how is it used as a land management technique? [10 Marks]

END OF EXAMINATION
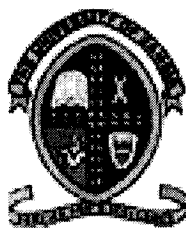
UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY SECOND SEMESTER EXAMINATIONS: DECEMBER 2005

AGS 542: SOIL GENESIS AND CLASSIFICATION

INSTRUCTION: Answer all questions   **TIME:** 3 Hours   **Marks:** 80

1. Given two types of rocks granite and basalt weathering under the environment experienced in Region III of Zambia. Describe and compare the soil types you would expect to develop from these rocks. (10 marks)

2. A soil is described as fine loamy Kaolinitic Isohypethermic Typic Plinthaquox. (12 marks)

a) Briefly explain its main physical and chemical features

b) Where in Zambia would you expect to find this type of soil and why?

c) What the potentials and limitations of this soil for agricultural purposes?

3. With the aid of a well labeled diagram explain the influence of fauna and vegetation on soil differentiation. (8 marks)

4. You have been contracted to carry out a detailed soil survey of a farm to be used for agricultural purposes. In one of the soil units you have identified you note the presence of the following horizon: Ah, E, Bt, and Btn. What do these horizon notations represent? (6 marks)

5. With the aid of well balanced equations, describe three (3) chemical weathering processes. (12 marks)

6. Explain and illustrate the relationship between the following and soil formation (12 marks)

a) Rainfall

b) Temperature

c) Weathering of primary minerals and clay content.

7. Describe the structure of the U.S. soil taxonomy.   (10 marks)

8. Explain and illustrate the parent material cycle   (10 marks)

AGS 562: MANAGEMENT OF IRRIGATION AND DRAINAGE SYSTEMS

TIME: THREE (3) HOURS

MARKS: SIXSTY (60)

INSTRUCTION: ANSWER ALL QUESTIONS

Q 1   Evapotranspiration is critical in irrigation and drainage: **(15 Marks)**

   a) Define potential evapotranspiration and explain its importance in irrigation
      management
   b) One method used to estimate potential evapotranspiration is given by the
      formula:
$$ET_0 = 0.46 \cdot p \cdot (t + 17.8)$$
   i.   What is this method called?
   ii.   What are the various components in the given formula?
   iii. What are the two important factors in this formula which affect
         evapotranspiration?
   iv.   What factors considered important in evapotranspiration does this
         formula ignore.
   v.   When is this method considered unsuitable or inaccurate?

   c) Give what is considered the direct method of determining evapotranspiration?

   i.   Describe the equipment used in this method?
   ii.   What are the reasons advanced as to why this method actually over
         estimates evapotranspiration?

Q 2   There are three steps in the economic analysis of an irrigation project. The three
       steps are: -   Determination of feasibility, Ranking of alternatives, and
       Sizing of the project: **(15 Marks)**

   i.   Explain what is involved in each of the steps and its objective.
   ii.   How does one carry out each of the three steps and
   iii. What, if any, are the aids or tools used in the process?

Q3   There are three possible ways of calculating the amounts of ground water to be removed when designing drainage systems. Calculations are done using all three and the one giving the highest volume is usually selected.   **(10 Marks)**

      i.   Describe each of the three ways of calculating water volumes indicating the basis of each.
      ii.   Give the equation or formula which is used to determine how much water should be added to the soil in order to leach out salts to a level not harmful to plants.
      iii.   Describe all the components in the formula.
      iv.   What is this rather famous equation or formula called and explains why it is sometimes considered inadequate.

Q 4   When developing irrigation schedules or time tables, a number of policies may be used.   **(10 Marks)**

      i.   Explain the Displacement Policy
      ii.   A standard computer program is sometimes used in the process of developing these time tables. This program has three inbuilt options which it automatically considers. Name and describe each of the three.

Q 5   Irrigation may affect human health through water born disease and or ground water pollution by toxic substances: **(10 Marks)**

      i.   Name and describe the three mosquito borne diseases associated with irrigation development. How does one mitigate against these.
      ii.   Describe the potential pollutants of ground water which would specifically arise from Agricultural activities, including irrigation.

<div align="center">END OF EXAMINATION</div>