

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

SECOND SEMESTER FINAL EXAMINATIONS

2010-ACADEMIC YEAR-

1. AGA 322 - Ruminant Production
2. AGA 342 - Animal Breeding and Genetics
3. AGA 412 -Applied Animal Production
4. AGA 442 - Integrated Agriculture and fish Nutrition
5. AGA 422 - Game Ranching
6. AGA 542 - Animal Health
7. AGA 552 - Animal products and by-products
8. AGA 562 - Applied Animal Breeding
9. AGC 322 - Forage crop production
10. AGC 332 - Introductory plant pathology
11. AGC 342 - Principles of Crop Production
12. AGC 542 - Integrated pest Management
13. AGC 552 - Advanced Horticulture
14. AGC 562 - Seed science and technology
15. AGC 572 - Post Harvest technology
16. AGC 572 - Post Harvest technology (Deferred)
17. AGE 222 -Fundamental of Macro-economics
18. AGE 452 - Intermediate Agri business management
19. AGE 462 - Agriculture marketing and pricing

- 20.AGE 552 - Agricultural extension Education
- 21.AGE 572 - Agricultural Policy Analysis
- 22.AGF 332 - Methods in food analysis 1
- 23.AGF 352 - Food microbiology (practical)
- 24.AGF 352/BS 482 Microbiology
- 25.AGF 362 - Food Evaluation
- 26.AGF 342 - Food Toxicology
- 27.AGF 352 - Food Microbiology
- 28.AGF 422 - Nutrition
- 29.AGF 432 - Process control and Instrumentation
- 30.AGF 443 - Food packages
- 31.AGF 452 - Methods in food Analysis II
- 32.AGF 512 - Technology of meat and Fish products
- 33.AGF 522 - Technology of fermented products
- 34.AGF 532 - Technology of plant products II
- 35.AGF 542 - Plant design
- 36.AGS 222 - Fundamentals of food science
- 37.AGS 331 - Soil Survey techniques
- 38.AGS 322 - Soil Physics
- 39.AGS 422 - Soil Microbiology
- 40.AGS 452 - Principles of Land husbandry
- 41.AGS 522 - Soil and Plant Analysis
- 42.AGS 542 - Soil genesis and classification
- 43.AGS 562 - Management of irrigation and drainage systems

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2010 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 different answer books for Sections 1 and 2.
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SECTION A – BEEF PRODUCTION:

- Q. 1 In December 2009, Achimwene Banda from Malawi, Selma Nangula from Namibia and Nasilele Kapijimpanga Musonda from Zambia were asked by Southern African Development Community (SADC) to establish a regional beef demonstration centre in chief Haamusonde area in Southern Province, Zambia. The centre is to be used to train farmers in various practical aspects of beef farming. They decided to buy 2 Tonga bulls and 60 boran cows. The following year in 2010, 55 calves (25 male and 30 female) were born between 1st September and 28th November presenting a calving percentage of 92%. Comment on the performance of this demonstration centre in terms of;
- a) Breeding Ratio (5 marks).
 - b) Type of breeding or breeding system they used. Is it correct or wrong? Give an explanation to support your answer (5 marks).
 - c) Breeding season used. Is it correct or wrong? Give reasons to support your answer (10 marks).
- Q. 2 More than 80% of beef cattle are owned by traditional farmers in Zambia. The animals suffer from various form of poor management which if corrected could improve the performance of these animals.
- a) What are the recommended routine operations that should be carried out to improve the performance of these animals? Please indicate why and when each routine should be carried out (15 marks).
 - b) What is the recommended slaughtering procedure of these beef animals in order to produce good quality beef (5 marks)?

SECTION B – DAIRY PRODUCTION:

- Q. 3 Explain how you would feed and manage a newly born calf up to the time of weaning. What are the key management considerations that you would undertake?

- Q. 4 Assuming that you would like to establish a dairy business through the cross breeding of the local cattle with the exotic dairy breeds. Explain the steps that you would take in order to improve the herd of cattle over the years. What assisted animal production techniques would you wish to make use of and why?

SECTION C – SHEEP AND GOAT PRODUCTION:

- Q. 5 In Zambia, sheep and goats are used as sources of income by many households and also provide as sources milk and meat, i.e. mutton and chevon. Sheep and goats are also very well known for their high fertility, short gestation period and their resistance to number of diseases. Being ruminants, sheep and goats, should depend fully and mostly on natural grazing.
- Discuss the factors that may affect the dry matter intake of sheep and goats on farm of your choice.
 - Discuss the factors that should be taken into consideration in the process of selecting of the ram and the buck as breeding stock?
- Q. 6 Having been recently appointed as the Farm Manager of an intensive sheep and goat enterprise in Lusaka West, 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 Rabbit production is especially adapted to villages, small farms and in urban areas where other types of livestock cannot be raised. A farmer from Mumbwa West would like to establish a rabbit unit at his farm.
- Write notes on any five (5) the factors that may affect feed intake in rabbits.
 - As an expert advise the farmer where to obtain breeding stock and what to look for in good breeding rabbits.
- Q. 8 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 and is highly recommended for the aged, the sick and children. In addition, rabbits are small and very cheap to purchase and to house; therefore, the initial capital outlay is minimal because 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.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2010 ACADEMIC YEAR – SECOND SEMESTER DEFERRED 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 and clearly show all the calculations.*

Q. 1 a) Explain the sequence of events that take place during Prophase I of Meiosis and indicate their genetic consequences.

b) Assume that in the fruit fly, *Drosophila melanogaster*, there are three (3) pairs of alleles +/a, +/b and +/c. As shown by the symbols each mutant allele is recessive to its wild type allele. Across between females that are heterozygous at all three loci and wild type males gives the following results:

+ b +	441
a + c	430
a b c	39
+ + c	32
+ + +	30
a b +	27
+ b c	5
a + +	3

- Are these genes linked? Justify your answer.
- What is the correct order of the genes?
- What are the genotypes of the flies involved in the parental cross and the test cross?
- What is the map distance between the genes?
- Calculate the coefficient of coincidence.

Q.2 Write notes on mutagenic agents.

Q. 3 a) Given that the genes R, S and T are linkage group with 15% recombination between R and S, and 25% recombination between S and T; and that the Coefficient of Coincidence is 0.6, what are the expected frequency of phenotypes from a test cross whose progeny are 1000?

b) An animal scientist studying the heritability of growth rate in Angoni Cattle at UNZA's Liempe Farm in ten (10) beef cattle collected the following data in the year 2009. Below is the growth rate of the ten (10) beef cattle obtained from

Katete District (x) and the corresponding is the growth rate of their progeny (y).
Work out the heritability of growth rate in the Angoni cattle.

Growth rate of Angoni Cattle (x)	Growth rate of Progeny (y)
1.05	1.00
1.00	1.00
0.85	1.00
0.90	0.95
1.00	1.05
1.10	1.00
0.90	0.95
0.95	1.00
1.00	1.20
0.90	0.95

Q.4 Briefly explain what is meant by each of the following:

- i. Phenotype;
- ii. Autosexing;
- iii. Sex linkage;
- iv. Transcription;
- v. Linkage group;
- vi. Duplicate gene action;
- vii. Dicentric chromosome;
- viii. Xenophobia pimentosum;
- ix. The law of segregation; and
- x. Co-dominance and multiple alleles;

Q. 5 a) Given that the genes R, S and T are linkage group with 15% recombination between R and S, and 25% recombination between S and T; and that the Coefficient of Coincidence is 0.6, what are the expected frequency of phenotypes from a test cross whose progeny are 1000?

b) Work out the following:

- i. Given that a group of 6 month-old-weaner calves has an average weight of 170 kg from which selected breeding stock with an average weight of 185 kg is selected. If the heritability of live-weight is 40%, what is the average weight of the first generation progeny of the selected breeding stock?
- ii. If in a population of pigs, the heritability in the narrow sense for the mature weight is 0.5, the phenotypic variance is 100 kg, the total genetic variance is 50 kg and the epistatic variance is 0 kg, calculate the dominance variance and the environmental variance.

Q. 6 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?

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2010 ACADEMIC YEAR – SECOND SEMESTER DEFERRED EXAMINATIONS

COURSE AGA 342 – ANIMAL BREEDING AND GENETICS

TIME ALLOWED: THREE (3) HOURS ONLY

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END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

END OF SECOND SEMESTER EXAMINATIONS

JULY – AUGUST 2001

COURSE AGA 412 – APPLIED ANIMAL PRODUCTION

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

- i. Answer all five (5) questions.**
 - ii. All questions carry equal marks.**
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Q1 Chemical disinfection is one method of ensuring a disease free environment for housed animals. Which four (4) chemical disinfectants available on the Zambian market would you recommend for use in disinfecting pig and poultry houses? Give reasons for your recommendations.

Q2. Write briefly on the following:

- i. Moulting in chickens.
- ii. Facilities required in a commercial hatchery
- iii. Two types of village chicken
- iv. Feeding quails

Q3 Imagine you have been employed by a 20,000 broiler rearing company which has just fired all its workers due to total negligence of duty. One of your duties is to direct and supervise the activities of new broiler production attendants. Upon visiting the ten poultry houses, each having 2,000 birds, you see on the outside pools of stagnant water everywhere left by the rain. At the door of several poultry houses you are met with an irritating pungent smell coming from inside. Inside the buildings you often notice the chicks are huddled up in the corners. The chicks have white feathers covering most of the body but with yellow down feathers still covering the head. The birds look weak and stunted and their droppings generally show stains in different variations of the colour red. Most of the feeders and drinkers are empty and the feed storage is empty. You are

informed that there have been high mortalities from all the houses but there are no records.

- i. Give details of your assessment of the previous management and care of the birds and their environment.
- ii. What is the biochemical basis for your observations?
- iii. What instructions would you give the animal attendants in order to save the remaining flock?

Q4 Explain the variation in protein, energy and calcium content for the different Zambia Bureau of Standards recommended feeds for commercial pigs.

Q5 Compare and contrast the management of pigs reared under the 'scavenging management system' and those reared under the 'intensive management system'. What consequences do the management practices utilized under the two systems have on the performance of the pigs?

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2010-2011 ACADEMIC YEAR: SECOND SEMESTER
FINAL EXAMINATIONS

AGA 442: INTEGRATED AQUACULTURE AND FISH NUTRITION
PAPER

TIME: THREE HOURS

INSTRUCTIONS: ANSWER FIVE QUESTIONS. ANSWER QUESTIONS 1 AND 5.
ANSWER TWO QUESTIONS FROM EACH SECTION AND THE FIFTH QUESTION
FROM EITHER SECTION. USE DIAGRAMS AND OTHER ILLUSTRATION AS
APPROPRIATE. USE SEPERATE ANSWER BOOKS FOR EACH SECTION.

SECTION A: INTEGRATED AQUACULTURE

1. Suggest **causes** and **solutions** to the following problems experienced in small scale integrated fish farming:
 - (a) Excessive water loss from earthen ponds.
 - (b) Failure of the fish pond water to respond to fertilisation or addition of manures.
 - (c) Fish not able to grow to market size as expected during a production cycle.
 - (d) Excessive escape of farmed fish from earthen ponds.
 - (e) The reluctance of financial institutions to provide credit to both small and medium scale farming projects.
2. A former Civil Servant based in Kaoma, Western Province, has decided to start fish farming using semi-intensive fish cum duck farming methods after failing to become a member of parliament in the 2006 elections. A preliminary survey of his farm indicated that he could use 3,000 m² for the production ponds. The topography of the area where the production ponds are to be located is such that it is possible to have fish production ponds of the same size.
 - (a) Indicate the **number** and **sizes** of production ponds that you would recommend for the intending fish farmer. Give reasons for your suggestions.
 - (b) Estimate the number of **fingerlings** and **ducks** needed for the production ponds annually.
 - (c) Estimate the area that would be required for **breeding** and **nursery** ponds.
 - (d) Approximate the annual water requirement for the **entire** fish farm.
3. Compare and contrast aquaculture systems used for Cichlids and Cyprinids in either medium or small scale fish farming systems indicating advantages and problems for each one.
4. (a) Summarise the methods that are used in farming fish of species of the Family Claridae, the barbel fishes.
(b) Highlight some of the advantages and difficulties associated with farming fishes of this family.

TURN OVER

SECTION B: FISH NUTRITION

5. Explain in detail the following in the context of fish nutrition or aquaculture
 - (a) Cyanophyta and Chlorophyta.
 - (b) Energy requirements for fish are lower than that terrestrial animals
 - (c) Live foods.
 - (d) Types of fish feeds.
 - (e) Nutritional requirements of the *Tilapia*.

 6. (a)-Indicate the sources of plant proteins that a fish nutrition research expert would select in order to formulate a fish diet that would substitute animal proteins.
(b) Outline the pros and cons of each of the plant protein sources selected and discuss the factors that justify their selection if used to substitute animal protein in the formulation process.

 7. Give details on the **role** and **sources** of major fish feed nutrients in aquaculture nutrition.

 8. (a) Discuss the precautions that could be considered in order to provide good storage conditions for fish feeds.
(b) Highlight examples and estimates of the maximum permissible storage time for selected feedstuffs in tropical areas.
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END OF THE EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURE

2010-2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGA 422: GAME RANCHING

TIME: THREE HOURS

INSTRUCTIONS: QUESTION **ONE** IS COMPULSORY. ANSWER QUESTIONS **ONE** AND **FOUR** OTHERS. USE ILLUSTRATIONS WHERE NECESSARY.

1. (a) A rodent survey in the ranch area used a capture-recapture method to determine the distribution and habitat preference of the Cane Rat (*Thryonomys swinderianus*). The technique however requires that before a large number of traps can be set, it was important to test the behavioural pattern of the rat. Therefore, seven (7) traps were set at different points in the area for 15 days, and each captured rat was marked and released. The following data were obtained.

TRAPS	A	B	C	D	E	E	G
RATS CAUGHT	6	9	23	14	18	0	3

From the data provided, determine whether or not the capture of each rat was independent of the location of the trap.

1. (b) In the same area, a census of the same species involved setting up of a number of traps at different points along each transect in the area for two occasions, and each captured rat was marked and released. The data in the Table below were obtained.

TRAPS			
TRANSECTS	A	B	C
Initial capture	06	09	10
Second capture	12	13	11
Recaptures	03	08	03

- (i) Using the Lincoln – Petersen index method, calculate the populations of the rats in the area.
 - (ii) Discuss the limitations of this method in estimating wildlife populations.
2. Describe the main characteristics of a wildlife habitat and relate these to the ecology of the following species:
 - (a) Tsessebe (*Damaliscus lunatus*)
 - (b) Sitatunga (*Tragelaphus spekei*)
 3. Discuss the management application of the following concepts as used in wildlife population management:
 - (a) Maximum Sustainable Yield.
 - (b) Point-centered method
 4. Discuss features that would indicate that a wildlife species population was being over exploited in the ranch and prescribe measures most significant in reversing the trend.
 5. Discuss difficulties associated with the translocation and restocking operations in wildlife management.
 6. Munyamadzi Farms Ltd is considering establishing a game sanctuary in Kalomo District along the Nazhila 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 and Cooperatives in Choma, the soils are generally Fersiallitic and excellent for a game sanctuary. The average rain fall is 800mm and the vegetation is dominated by Acacia-Combretum woodland and dry Miombo. And also results from your preliminary investigations indicate that the production of key forage species averages about 100kg/ha of dry matter per year. The proposed Sanctuary is 10,000 ha in size. Assuming that allowable use is 25% and daily dry matter intake is 2% of the animal body weight,
 - (a) Determine the number of 204 kg Hartebeest you would stock as your base herd in the area
 - (b) Discuss the limitations of this method in estimation the stocking rate of wildlife species.

7. Discuss in detail the management application of the following terms as used in Game Rancing:

- (a) Kidney / Fat Ratio Index
- (b) King Census method and its modification

8. Study carefully Figures 1 provided and answer the following questions:



Fig. 1.

- (a) Name the Order to which the species belongs
- (b) Give its scientific name
- (c) Discuss the habitat of the species
- (d) Discuss the feeding habits of the species

END OF EXAMINATION

**UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE**

**2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATION**

AGA 542: ANIMAL HEALTH

TIME: THREE HOURS

INSTRUCTIONS:

1. Please read the instructions and each question carefully.
 2. Answer ALL questions.
 3. Write the answers to each question in a separate examination answer book.
 4. All questions carry equal marks.
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1. Animal diseases constitute a major obstacle to livestock production in Zambia. However, animals counteract diseases through several protective mechanisms and barriers.
 - a) Outline the physical barriers by which animals counteract infection. **(5 marks)**
 - b) With the aid of a table, show the differences between primary and secondary immune responses in cattle following administration of two doses of a vaccine 4 weeks apart. **(5 marks)**
 - c) Outline the major cells of the immune system and their functions. **(5 marks)**
 - d) List the primary and secondary immunological organs. **(5 marks)**
2. Write short notes on any **four (4)** of the following
 - a) Effects of livestock disease on livestock productivity and human welfare. **(5 marks)**
 - b) Depopulation as a method of disease control. **(5 marks)**
 - c) The tick, *Rhipicephalus appendiculatus*. **(5 marks)**
 - d) Direct losses associated with infestation of cattle with ticks. **(5 marks)**
 - e) Diagnosis and treatment of trypanosomosis in cattle. **(5 marks)**
3. Compare and contrast Anthrax from Haemorrhagic Septicaemia on the basis of their identification, transmission dynamics, geographic distribution/occurrence and control. **(20 marks)**
4. Write concise notes on the following:
 - a) Clinical signs and treatment of Bovine Babesiosis. **(5 marks)**
 - b) Diagnosis and control of Theileriosis. **(5 marks)**
 - c) Transmission and postmortem signs of Anaplasmosis. **(5 marks)**
 - d) Postmortem signs and diagnosis of Cowdriosis. **(5 marks)**

5. Infectious diseases result from invasion of susceptible animals by microorganisms through various routes, and their subsequent proliferation and spread in the animal body to exert their effects on the host.
- a) Outline the various routes of infection. **(5 marks)**
 - b) Lists any **five (5)** factors that affect the outcomes of infection. **(5 marks)**
 - c) List the types of infectious agents and state how they cause disease. **(5 marks)**
 - d) Briefly describe the similarities and differences between passive and active immunity. **(5 marks)**

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END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

**SCHOOL OF AGRICULTURAL SCIENCES
2010/2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGA 552 ANIMAL PRODUCTS AND BY-PRODUCTS

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:

- 1) ANSWER ALL QUESTIONS**
 - 2) WRITE EACH SECTION IN A SEPARATE ANSWER BOOK**
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SECTION A (Meat)

QUESTION 1 [35 POINTS]

Write short notes on the following:

- a) Steric effect in relation to water holding capacity [7]
- b) Accumulation of lactic acid in muscle post-mortem [7]
- c) Effects of accelerated temperature drop in muscle post-mortem [7]
- d) Influence of aging of beef on tenderness [7]
- e) Meat juiciness [7]

SECTION B (Milk)

QUESTION 2 [15 POINTS]

Milk quality is of paramount importance in the production of quality dairy products.

- a) Discuss the types of tests carried out on raw milk at the reception point of the milk processing plant. [8]
- b) An enterprising farmer sales raw milk in 2 litre containers. He approaches you with a problem of a cream layer at the top of his containers which, his clients do not like and is difficult to clean after the milk has been removed. Explain the phenomenon causing the problem and give the possible solution. [4]
- c) Explain the difference between spoilage and pathogenic bacteria and give an example for each. [3]

QUESTION 3 [15 POINTS]

- a) Explain in detail with illustrations, the UHT milk manufacturing process. **[10]**
- b) Give two tests used to distinguish a UHT milk sample from a pasteurized milk sample in the laboratory. **[2]**
- c) Discuss the symbiotic relationship of the yoghurt cultures. **[3]**

SECTION C (Eggs)

QUESTION 4 [20 POINTS]

The bird egg is a marvel of nature. It is one of the most complete foods known to humans, as evidenced by the excellent balance of proteins, fats, carbohydrates, minerals, and vitamins which it provides during the 20-day in-the-shell period when it serves as the developing chick's only source of food.

- a) Mention and explain the components that make up the egg. [6]
- b) What are the normal physical characteristics of eggs [4]
- c) Periodically, a deviation in the mechanics of egg laying will create abnormal eggs. Some of these abnormalities occur due to management problems or they can also be physiological. What are these common abnormalities and suggest ways of correcting them. [5]
- d) How should eggs be processed so that there is maximum benefit for the industry and local consumers [5]

SECTION D (Hides and Skins)

QUESTION 5 [20 POINTS]

About 40% and 60% of total hides and skins respectively produced in the traditional livestock sector in Zambia are wasted, incorrectly processed or simply thrown away. Those which find their way to the tanner are of poor quality.

- Explain why there is such excessive wastage of hides and skins from these traditional farmers. **[6]**
- Mention and explain the causes of the damage to the skins and hides which makes it difficult for the tanners to buy these hides and skins **[8]**
- Hides and skins can be converted into a non putrefiable, flexible and workable product through tanning. Describe the process of tanning. Mention some products of tanning. **[6]**

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END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS – MAY, 2011
AGA 562 – APPLIED ANIMAL BREEDING

TIME: 3 HOURS

INSTRUCTIONS: **ANSWER ANY FIVE (5) QUESTIONS.**

1.
 - a. Explain what is meant by genetic and environmental interactions?
 - b. Briefly define genetic progress and how is it calculated?
 - c. Explain how heterosis is calculated and what are the possible genetic causes for it?
2. Discuss the test procedures used to eliminate genetic defects that are dependent on a single recessive gene in a livestock population.
3.
 - a. Define or explain “coefficient of inbreeding.”
 - b. How does inbreeding affect gene action known as over-dominance?
 - c. Explain the effect you believe that the practice of inbreeding has on the frequency of recessive lethal genes, the incidence of genetic abnormalities, and the likeness between herds within a purebred breed.
4.
 - a. Define gene frequency.
 - b. Briefly outline the Hardy-Weinburg rule.
 - c. Explain the circumstances under which chance or “genetic drift” may be an important factor concerned with change of gene frequency.
5. Discuss the methods based on relationships most widely used to determine heritability in farm animals.
6.
 - a. Selection is an important tool used in the improvement of livestock. What are the factors selection depends on for effectiveness?

You have been appointed the Officer responsible for developing a new breed of village chicken to be distributed in most areas of Zambia. The breed is to have high egg production and have good meat characteristics. How would you go about developing the breed, clearly state the method you will employ and give reasons for choosing the particular selection method to accomplish your assignment.

END OF EXAMINATION



The University of Zambia

School of Agricultural Sciences

Department of Crop Science

Second Year Examinations for the Degree of Bachelor of Agricultural Sciences

AGC 322: Forage Crop Production

Second Semester, 2011

Date: 6 May, 2011

Time: 09.00 – 12.00hrs

Instruction to Candidates

Answer any five questions. All questions carry equal marks

1. Achimwene Gondwe from Malawi, Boneficus Singu from Namibia and Bwalya Bulaya from Zambia have been asked by Southern African Development Community (SADC) to establish a regional fodder bank in Chief Sinazongwe in the rangelands of Southern Province, Zambia.
 - a). Name two pasture legumes that could be included in the fodder bank and indicate their agricultural importance. (8 marks).
 - b). Fodder trees or browse trees are the third component of natural grazing resources that could be included in the fodder bank.
 - i). What is the importance of including fodder trees in fodder bank?(4 marks).
 - ii). What are the problems associated with use of these fodder trees as feed for the grazing animals (4 marks).
 - iii) How should they be managed to improve their productivity (4 marks).
2. During one of the forage crop production lessons a student was asked to define rotational grazing and he said that rotational grazing is a kind of grazing where the animal rotates while it is grazing. The other students upon hearing this laughed a lot.
 - a). From your understanding of rotational grazing would you agree or disagree with this definition? Give an explanation for your answer (5 marks)
 - b). What are the benefits of rotational grazing (4 marks)
 - c). Explain why herbage ingested or eaten by grazing animals may differ markedly in botanical and chemical composition from that of the pasture from which the animal is grazing (5 marks)
 - d). What are the factors that affect grazing time (6 marks)

3. You have been giving a series of talks to cattle farmers in Mchinji area in Malawi concerning feeding their animals. Last time you discussed how to conserve forage through making of Hay and silage. For the next lesson indicate what you would tell the farmers as regards the following questions they asked last time.
 - a) What are the characteristics of good quality hay (9 marks)
 - b) how should hay be enhanced to improve its feeding value before giving it to animals (4 marks).
 - c) What are the characteristics of good quality silage (7 marks).

4. "The Lord is my shepherd I shall not want (I shall not lack anything). He maketh (makes) me to lie down in green pastures". So says the Psalmist
 - a). Draw a graph to show that grazing animals sometimes lack green pastures at certain times of the year in arid and semi-arid lands of Southern Africa. Please explain the meaning of the graph (10 marks).
 - b). If you were a good shepherd like our Lord what would you do to ensure continuous supply of adequate feed to grazing animals throughout the year (10 marks).

5. In a Village in Chief Mpezeni, the chief had called for a meeting to settle a dispute between two of his subjects. The accused Mr Mbuzi, was blamed for setting his bush surrounding his house ablaze. Now the fire had gone on to Mr Mafuta's farm where it burnt all the surrounding bushes. The problem is that Mr Mafuta is a dairy farmer who depends on the surrounding bush for grazing his animals. Mr Mafuta has sued Mr Mbuzi for burning his grazing area and would like him to pay for the damage and suffering caused by the fire. Mr Mbuzi has however refused to pay because he thinks the bush is communally owned and was not planted or cultivated by anyone. Infact he thinks he has done his neighbours a favour by burning and clearing the bush thereby driving snakes and other dangerous animals away.
 - a) How do you think this dispute should be resolved. Do you think Mr Mafuta should be compensated for the loss of his valuable feed resource (5marks).
 - b) From this story list the problems a farmer faces in using natural pastures as a source of feed for his animals (7 marks).
 - c) Mention any two other grazing methods you know and what are their advantages and disadvantages (8 marks).

6. A farmer on Kaprivi Strip in Namibia sold off 150 Nguni cattle he had. He then imported the following herd of cattle for his farm; 2 Boran bulls from South Africa , 2 Brahman cows from Botswana, 1 Angoni bull, 20 Angoni Cows and 10 Angoni heifers from Zambia. 15 of the 20 Angoni cows came with a calf each,. He has 10 hectares of field crops, 30 hectares of citrus fruits, 177 hectares of natural grazing land. **Take 1 livestock unit to 5 hectares**
 - a) Define stocking rate (5 marks).
 - b) Is this farmer overstocking or understocking his grazing land? Show all calculations to support your answer (10 marks).
 - c) What would be your advice to this farmer (5 marks).

Livestock Units of Different Breeds of Cattle

Breed	Cow	Bull	2-3 Years	1-2 Years	5-11 Months	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

6 goats = 1 Livestock unit

6 sheep = 1 Livestock unit



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

**PROGRAMME: BACHELOR OF AGRICULTURAL SCIENCES- THIRD YEAR
AGC 332: INTRODUCTORY PLANT PATHOLOGY
2010/2011 ACADEMIC YEAR, SEMESTER II.**

DATE: 17th May, 2011 TIME: 09:00 – 12:00HRS

INSTRUCTIONS:

- 1) Answer **question 1** and **any other 4** questions,
- 2) All question carry equal marks.
- 3) Duration 3 (three) hours.

Question 1

- a) Indicate whether the following statements are true or false
 - (i) All plant viruses are biotrophs.
 - (ii) Spore is a symptom
 - (iii) *Phytophthora infestans* is a bacterium.
 - (iv) Leaf diseases of sorghum can infect sweet potatoes.
 - (v) An avirulent pathogen is not pathogenic.
 - (vi) Ascospores are always 6 in number.
 - (vii) Root knot nematode has a wide host range.
 - (viii) Plant viruses are predominantly DNA based.
 - (ix) Disease incidence is the measure of damage done by a plant.
 - (x) Bacterial ooze is a symptom of a bacterial infection.

- b. Explain the following:

- i. Horizontal resistance.
- ii. Alternate host.
- iii. Blight.
- iv. Gall.
- v. Scab.

[20 marks]

Question 2

- a) List the genera of bacteria and give one disease example of each.
- b) Describe five major symptoms of bacterial diseases.
- c) How are bacterial diseases managed?

[20 marks]

Question 3

- (a) Explain the following as used in classification of viruses

- (i) Biological properties.
- (ii) Serological properties.
- (iii) Genome properties.
- (iv) Particle morphology.

- (b) How are viral diseases managed?

[20 marks]

Question 4

- (a)

pathogen

Virulence or avirulence genes in the host	Resistance or susceptibility genes in the plant	
	R (resistant) dominant	r (susceptible) recessive
A (avirulent) dominant		
a (virulent) recessive		

Fill in the above and explain the disease reactions which follow.

- (b) Define plant disease cycle. Describe the 5 (five) stages of the disease cycle. [20 marks]

Question 5.

What is integrated plant disease management? List and explain the 6 (six) basic components of integrated disease management. **[20 marks]**

Question 6

- a) How do plant parasitic nematodes cause disease and what are the symptoms associated with Nematode attack?
- b) How are nematodes managed? **[20 marks]**

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA

School of Agricultural Sciences

Department of Crop Science

Third Year Examinations for the Bachelor of Agricultural Sciences

AGC 342: Principles of Crop Production

Second Semester 2010/2011 Academic Year

Date: 11th May, 2010

Time: 14:00 –17:00 hrs

Instructions:

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

QUESTION 1 (15 Marks)

- a) Why are soil measurements with a Neutron probe not determined at a depth lower than 20 cm? **(3 Marks)**
- b) What is Nutrient depletion? **(3 Marks)**
- c) What is yield response factor? **(3 Marks)**
- d) How is irrigation interval calculated from Actual and Maximum Evapotranspiration? **(3 Marks)**
- e) What are the common constituents of growth media? **(3 Marks)**

QUESTION 2 (25 Marks)

A

- i) What is soil water potential? **(2 Marks)**
- ii) Express soil water potential as energy per unit mass and energy per unit weight. **(2 Marks)**
- iii) What is the advantage of using the concept of soil water potential? **(3 Marks)**
- iv) How is soil water storage derived? **(3 Marks)**

B

The rainfall over 10-day period was 13 mm. A farmer has irrigated her crop with 9 mm water. Assuming drainage of 2 mm, negligible runoff and the soil water storage of 10 mm was measured. What was the evapotranspiration? What could the time of the year the measurements were taken. **(15 Marks)**

QUESTION 3 (20 Marks)

- i) Several factors influence photosynthesis, explain how each of these factors affect photosynthesis. **(10 Marks)**
- ii) Explain how Crassulacean Acid Metabolism (CAM) is a strategy to cope with very hot and dry desert conditions. **(10 Marks)**

QUESTION 4

- i) Which are three phytohormones involved in each of the following processes; germination and senescence in plants? **(5 Marks)**
- ii) Explain how these phytohormones in conjunction with external factors regulate these growth processes. **(15 Marks)**

QUESTION 5 (20 Marks)

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

- a) Give 2 members of each family, **(4 Marks)**
- b) What are their scientific names and places of origin, **(4 Marks)**
- c) Briefly describe their morphological features, **(5 Marks)**
- d) What are 3 optimum conditions of growth, **(3 Marks)**
- e) How are these crops important to the national economy. **(4 Marks)**

END OF EXAMINATION



UNIVERSITY OF ZAMBIA

**School of Agricultural Sciences
DEPARTMENT OF CROP SCIENCES
B. Agric. Sci. Programme- Second Semester Final Examinations
AGC 542: INTEGRATED PEST MANAGEMENT**

Date. 6th May 2011

Time 09:00 to 12:00 hrs

INSTRUCTIONS

1. Answer ANY 5 (FIVE) questions.
2. Duration- 3 (THREE) hours.

-
1. Insects have a lot of enemies. Discuss the various defense mechanisms used by insects. **[20 marks]**
 2. What is cultural control? Describe the various components of cultural control used in Integrated Pest Management (IPM) programs. **[20 marks]**
 3. Transgenic crops are used as a tool in IPM programs. Describe the major steps involved in the development of transgenic crops. **[20 marks]**
 4. Pesticides are a major component of IPM programs. Describe the various classification systems used for pesticides. **[20 marks]**
 5. The bollworm [*Helicoverpa armigera* (Huber)] is a major pest of cotton (*Gossypium hirsutum*). Construct a conceptual model showing the development stages of the bollworm and describe the State, Rate and Driving variables that affect their development? **[20 marks]**
 6. A new pest has just been introduced into Zambia. You have been requested to identify a suitable Biological Control Agent. What steps are you going to follow in identification and introduction of the biological control agent? **[20 marks]**
-

END OF EXAMINATION



UNIVERSITY OF ZAMBIA

School of Agricultural Sciences
DEPARTMENT OF CROP SCIENCES
B. Agric. Sci. Programme- Second Semester Final Examinations
AGC 552: ADVANCED HORTICULTURE

Date. 10th May 2011

Time 14:00 to 16:30 hrs

INSTRUCTIONS

1. Answer ANY 4 (FOUR) questions.
2. Duration- 2.5 (two and half) hours.

-
1. Indigenous trees have historically played an important role in our dietary needs. Their utilization has declined, can you give concise description of the priority activities for their increased utilization locally. Additionally what are the limitations for their entry into the international market? [25 marks]
 2. Write short notes on
 - a. Role of storage carbohydrates in plant development;
 - b. Photorespiration.
 - c. Rejuvenation pruning.[25 marks]
 3. Describe the different photosynthetic systems and how each of them affects productivity efficiencies of each category of plants. [25 marks]
 4. Describe fully the pruning and training systems of mango (*Mangifera indica*) and oranges (*Citrus sinensis*). [25 marks]
 5. As a Horticultural Officer can you develop an Extension Bulletin on how to successfully improve small scale Banana (*Musa* spp) production in Zambia? In your answer include the different cultivars, climatic condition and cultural practices. [25 marks]
-

END OF EXAMINATION



UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCES

SEED SCIENCE AND TECHNOLOGY

AGC562

FINAL EXAMINATION

Date: Wednesday 18th May 2011

Time: 09:00 – 12:00 hours (3 hour)

Venue: Omnia.

Level: For fifth years

INSTRUCTIONS

Question 1 is compulsory, answer it. Questions 2, 3 and 4 are optional. Answer only 2 of them. Points for each question are indicated.

COMPULSORY

Q1 (30 points)

- a) Define a seed program
 - b) Describe a seed program by outlining all its components and how they are interlinked
 - c) What is a variety and how do you differentiate among the following:
 - A single cross hybrid, a double cross hybrid, a synthetic, a top cross and a composite variety. Give examples of actual varieties falling in these categories
 - d) Discuss the experimental set ups, statistical analysis and reporting for performance and DUS trials.
-

OPTIONAL

Answer two questions only

Q2 (15 points)

- a) Define a seed, seed germination and seed vigor
- b) What are circadian rhythms and what is their importance to a seed technologists?
- c) What is the difference between
 - a. agamospermy and vivipary
 - b. Cleistogamous and chasmogamous
 - c. Protandry and protogyny
 - d. Anemophily and entomophily

Q3 (15 points)

- a) Outline the different types of seed dormancy and describe how to break each of them
- b) Describe the concept of the product life cycle and place the following varieties on that graph: MM752, SC709, PAN6363, PHB30G19 and DK8083
- c) Define seed certification and briefly describe the measures involved in the certification process.

Q4 (15 points)

- a) Enumerate the usual operations involved in seed processing and discuss what is involved in basic cleaning.
 - b) Describe recalcitrant seeds and give five examples of seed falling in this category
 - c) Describe the marketing strategy that SEEDCO uses.
-

--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 2010/2011
DEFERRED EXAM

Date: 10th June 2011

Time 14:00 to 17:00 hrs

INSTRUCTIONS

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

SECTION A [45 marks]

1. Using data explain the production, marketing and post harvest losses of onion (*Allium cepa*) in Zambia and how this differs from other common fresh vegetables.

[12.5 marks]

2. The following are the National Agricultural policy sectoral strategies. Explain why attention has to be paid to each of them in as far as post harvest is concerned.

- i. Reviewing and realigning institutional and legislative arrangements.
- ii. Facilitating availability of and accessibility to land for agriculture and development of infrastructure in potentially productive agricultural areas.
- iii. Promotion of gender equity in resource allocation and access to agricultural services.

[12.5 marks]

3. Write short notes on any THREE (3) of the following:-

- i. Drivers of standards,
- ii. Chilling injury,
- iii. Fermentation,
- iv. Reasons for adopting quality control.

[20 marks]

SECTION B [45 marks]

4. (a) A grower/packer is growing lemons in the tropical lowlands on the African continent. Once these lemons have been delivered to the packinghouse, list the operations the fruit has to undergo before packing. How and why is each operation carried out? **[25 marks]**

- (b) List the type of infection that leads to the development of each of the following

Diseases:-

- | | |
|-----------------------------------|--------------------------------|
| 1. <i>Geotrichum candidum</i> | 4. <i>Diplodia Natalensis</i> |
| 2. <i>Phytophthora hibernalis</i> | 5. <i>Penicillium italicum</i> |
| 3. <i>Trichoderma viride</i> | 6. <i>Alternaria citri</i> |

[6 marks]

5. Product losses can occur during post harvest handling of commodities. What are the different techniques used to reduce losses in vegetable products? **[14 marks]**

SECTION C [10 marks]

6. Answer all questions in this section;

- a. Explain and illustrate the manufacturing process of pickled cucumbers using a flow diagram. **[6 marks]**

- b. Explain the difference between a dried and dehydrated product.

[1.5 marks]

- c. Chakwankwa Dried Fruits Ltd engages you as an expert to solve a problem of browning of their dried pears. Give two (2) possible causes and three (3) solutions.

[2.5 marks]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2010/2011 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS
AGE 222: FUNDAMENTALS OF MACRO-ECONOMICS

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS IN SECTIONS A, B AND C.

SECTION A

ANSWER ALL QUESTIONS

Multiple Choice Questions: Tick or circle the correct answer on the question paper and hand it in together with the answer booklet – (one mark each)

1. Macroeconomics is concerned with
 - (a) The level of output of goods and services
 - (b) The general level of prices
 - (c) The growth of real output
 - (d) All of the above
2. Real *GDP* increases
 - (a) When there is an increase in the price level
 - (b) When there is an increase in the output of goods and services
 - (c) When there is an increase in the population
 - (d) At a constant rate over time
3. In a disequilibrium model where the price level remains above the price level at which aggregate supply and aggregate demand intersect,
 - (a) Output is determined by the aggregate supply curve
 - (b) Output is determined by the aggregate demand curve
 - (c) There is an output shortage
 - (d) There is an output surplus
4. In a private sector model,
 - (a) Household saving is a leakage from the circular flow
 - (b) Investment is a spending injection
 - (c) Saving leakages equal investment injection
 - (d) All of the above
5. In an open economy model, *GDP* is the sum of
 - (a) Consumption, gross investment, government spending, and net exports
 - (b) Consumption, net investment, government spending, and net exports
 - (c) Consumption, gross investment, government spending and gross exports

- (d) Wages, rent interest, profit, and depreciation
6. In a closed economy, three sector model,
- (a) Household saving equals net investment
 - (b) Household saving equals gross investment
 - (c) Household saving plus depreciation equals gross investment plus government spending
 - (d) Household saving plus taxes plus depreciation equals gross investment plus government spending
7. Frictional unemployment exists
- (a) When there is a decrease in real GDP
 - (b) Because it takes time to find a job when one is first entering the labour force
 - (c) As a result of technological change
 - (d) When an individual retires
8. When saving is greater than investment in a two-sector model
- (a) Output should increase
 - (b) Output should decrease
 - (c) Output should not change
9. By definition, the marginal propensity to consume
- (a) Equals $\Delta C / \Delta Y_d$
 - (b) Is the behavioral coefficient c in the equation $C = a + cY_d$
 - (c) Is the slope of the consumption function
 - (d) All of the above
10. When investment is negatively related to the rate of interest, equilibrium output in the goods market
- (a) Is unrelated to the rate of interest
 - (b) Is inversely related to the rate of interest
 - (c) Is positively related to the rate of interest
 - (d) Falls as the rate of interest decreases
11. When the LM equation is $Y = K750 + 20i$, there is equilibrium between the supply and the demand for money when
- (a) The rate of interest is 10% and output is $K750$
 - (b) The rate of interest is 10% and output is $K800$
 - (c) The rate of interest is 10% and output is $K950$
 - (d) The rate of interest is 10% and output is $K900$
12. In which of the following situation will an increase in the money supply have no effect upon output?
- (a) LM is steeply sloped and IS is relatively flat
 - (b) LM is vertical and IS is steeply sloped
 - (c) LM is steeply sloped and IS is vertical
 - (d) LM is relatively flat as is IS

13. Crowding-out is more likely to occur when
 - (a) The demand for money is interest, sensitive, and private sector spending is largely interest – insensitive
 - (b) The demand for money is interest-sensitive, and private sector spending is interest-sensitive
 - (c) The demand for money is interest, and private sector spending is interest-insensitive
 - (d) The demand for money is interest-insensitive, and sector spending is interest-sensitive
14. Crowding out occurs when
 - (a) A decrease in the money supply raises the rate of interest which crowds-out interest-sensitive private sector spending
 - (b) An increase in taxes for the private sector reduces private sector disposable income and spending
 - (c) A reduction in income taxes results in a higher interest rate, which crowds out interest-sensitive private sector
 - (d) A reduction in government spending induces less consumption spending
15. Which of the following does not result in an increase in Zambia's net export?
 - (a) The Zambian Kwacha depreciates
 - (b) Output for Zambia's trading partners increase
 - (c) Foreign currencies depreciate
 - (d) Zambian trading partners lift tariff barriers
16. Which of the following does not increase output when exchange rates are fixed?
 - (a) There is an increase in the money supply
 - (b) There is an increase in government spending
 - (c) There is a decrease in taxes
17. Which of the following increases output when exchange rates are flexible
 - (a) There is an increase in the money supply
 - (b) There is an increase in government spending
 - (c) There is a decrease in taxes
18. The $M1$ definition of money is the sum of
 - (a) Currency outside banks and current account deposits
 - (b) Currency outside banks, current account deposits, and travelers' cheques
 - (c) Currency outstanding and current accounts deposits
 - (d) Currency outstanding, current accounts deposits and money market deposit accounts.
19. Which of the following statement is incorrect?
 - (a) The precautionary demand for money is unrelated to income
 - (b) There is a precautionary demand for money because of uncertainty about the receipt of future income
 - (c) The precautionary demand for money is affected by the opportunity cost of holding $M1$ balances
 - (d) There is a precautionary demand for money because of unexpected expenditures

20. If the opportunity cost of cars in terms of trucks is higher in country A than in country B, then
- (a) Country A should export trucks
 - (b) Country A should export cars
 - (c) We cannot tell because we do not know anything about comparative advantage.

SECTION B

True or False questions: Tick or circle the correct answer on the question paper and hand it in together with the answer booklet. (one mark each)

1. Keynesian economists take a noninterventionist approach to macroeconomic problems
T/F
2. Real *GDP* declines during a recession. *T/F*
3. When the consumption equation is $C = K40 + 0.90Y_d$, consumption is $K940$ when disposable income is $K1000$. *T/F*
4. The *Keynesian* model assumes that prices and wages do not adjust immediately to a change in aggregate supply and/or aggregate demand. *T/F*
5. A country which has cyclical unemployment has an unemployment rate greater than its natural rate. *T/F*
6. Gross domestic product is the sum of wages, rent, interest and profit plus indirect taxes and depreciation. *T/F*
7. An increase in the marginal propensity to import has the same effect upon the multipliers as an increase in the *MPC*. *T/F*
8. *IS* is vertical when investment is inversely related to the rate of interest. *T/F T/F*
9. The slope of *IS* decreases when there is an increase in the *MPC*. *T/F*
10. The *LM* schedule shifts to the right by $K_i \Delta M$ when there is an increase in the money supply. *T/F*
11. There is a liquidity effect every time the Central Bank changes the money supply. *T/F*
12. An increase in the money supply has a small effect upon output when the store of value demand for money is interest-sensitive. *T/F*
13. An increase in government spending always crowds out investment spending. *T/F*
14. An increase in the transactions demand for money ratio decreases the output effect of a change in the money supply. *T/F*
15. An increase in the marginal propensity to import decreases the slope of *IS*. *T/F*

16. The financial assets included in the $M2$ definition of money serve as a medium of exchange. T/F
17. An interest rate monetary policy stabilizes output when the location of IS is uncertain. T/F
18. According to the permanent income hypothesis, consumption is a fixed percentage of current income. T/F
19. A country has a comparative advantage over a second country in the production of the commodity in which it has a higher opportunity cost than the other country. T/F
20. The life cycle hypothesis suggests that high income households have a high APC . T/F

SECTION C: ANSWER ALL QUESTIONS

1. Given the following economic system

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

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

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

$$\text{Taxation} = 0.2Y$$

$$\text{Government} = 200$$

$$\text{Exports} = 200$$

$$\text{Imports} = 0.05 Y_d$$

- (a) Derive the equilibrium equation for Y . (4 marks)
- (b) If $i = 10\%$. What is the state of government budget? (4 marks)
- (c) If exports increase to 250, what is the new equilibrium level of income. (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) Find an equation for LM when the money supply is $K200$ and the demand for money is specified as $L = 0.20y - 4i$ (5 marks)
- (b) Given a two sector model where
 $C = K100 + 0.80Y$ and $I = K150 - 6i$, $M = K150$ and $L = 0.20Y - 4i$.
- (i) Find an equation for equilibrium in the goods market (IS) and for the money market (LM). (5 marks)
- (ii) Find output and the rate of interest at which there is simultaneous equilibrium in the money and goods markets (5 marks)
- (iii) Sketch the IS and (LM) equations and find equilibrium output and the rate of interest. (5 marks)
3. Explain what you understand of the following concepts (4 marks each)
- (i) Absolute advantage
- (ii) Recession
- (iii) Crowding out effect
- (iv) Liquidity trap
- (v) Phillips curve

END OF EXIMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2011 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS
AGE 452: INTERMEDIATE AGRIBUSINESS MANAGEMENT
TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER BOTH QUESTIONS IN SECTION A AND ANY TWO OF THE THREE QUESTIONS IN SECTION B.

SECTION A

- 1.- Running a successful agribusiness firm requires that you understand the environment you will be operating in and develop right marketing strategies to compete effectively. Choose a specific agribusiness product and detail out how you would strategically plan for its marketing **(25 Marks)**
2. You are an Agribusiness Consultant and have been invited by Citizens Economic Empowerment Fund (CEEC) to give a speech on business planning to potential loan applicants. Prepare your speech notes highlighting the following:
 - a) The definition of a business plan **(2 Marks)**
 - b) How the business owner benefits from developing a business plan **(8 Marks)**
 - c) Suggest a business plan format and its content **(15 Marks)**

SECTION B

- 3 i) If you were introducing a new electronic dairy feeding system that would reduce costs by 20 to 25 percent
 - a. What pricing policy would you suggest? Give reasons for your choice **(5marks)**
 - b. Would you stay with the policy indefinitely; explain your answer? **(4 marks)**
 - c. What promotional strategy would you use **(6 marks)**
- ii) Outline the principles of Total quality Management and how they can be applied in managing an agribusiness firm **(10 Marks)**
4. a) The decision of where to locate an agribusiness is a strategic issue. Discuss the statement and list the factors you would consider when choosing where to locate a pineapple processing plant **(20Marks)**
 - b. Describe two most commonly used methods by agribusinesses to track inventory **(5Marks)**
5. Write short notes on the following :
 - a) Sources of innovation as outlined by Peter Drucker **(7 Marks)**
 - b) Building blocks of successful entrepreneurship **(12 Marks)**
 - c) Linking the sizing of capacity cushion to competitive priorities, capacity intensity and resource flexibility decisions **(6Marks)**

THE END



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
Department of Agricultural Economics and Extension Education

Second semester final examinations 2010/11 academic year

Course: AGE462 Agricultural Marketing and Pricing

Date: 17th May, 2011

Venue: Other rooms

Duration: 3 hours

Total points: 100

Instructions

Answer all the questions.

1. Briefly discuss the following concepts:
 - a. Total elasticity
 - b. Homogeneity condition
 - c. Price rigidity in oligopoly
 - d. Marketing bill
 - e. Price transmission **(25 marks)**

2. A growing percentage of agricultural commodities are now being sold by contractual arrangements.
 - a. Discuss the main differences between a production and a marketing contract **(6 marks)**
 - b. Identify two (2) advantages and two (2) disadvantages of selling produce through production contracts for farmers **(8 marks)**

3. Mr. Mwale is a small-scale dairy farmer producing milk in Chongwe district. Suppose a new firm is established that uses milk to produce a specialized type of cheese, resulting in an increase in the price per liter of milk. However, the firm is forced to shut down due to food safety concerns, resulting in a decline in the price of milk. Use the supply response concept to explain how Mr. Mwale is likely to respond to the increase and subsequent decline in the price of milk. **(12 marks)**

4. Explain, with the aid of graphs, price determination in a pure (perfect) competition market structure for:
 - a. Storable agricultural commodities **(5 marks)**
 - b. Non-storable agricultural commodities **(5 marks)**

5. Suppose the retail price of pork chops is K18,000 per kilogram, the farm gate price of a pig is K6,500 per kilogram and a 300kg pig yields 150kgs of pork chops,
 - a. Calculate and interpret the farm-retail price spread **(8 marks)**

- b. Calculate and interpret the farm value as a percentage of the retail price (6 marks)
6. Briefly explain the Structure-Conduct-Performance (SCP) model. For each component of the SCP model, describe two issues that an industrial organization economist would evaluate (15 marks)
7. A cobweb model is an economic model that explains why prices might be subject to periodic fluctuations in certain types of markets. Use the cobweb model to show the effect of a drought on maize production in Zambia. (10 marks)

-----END OF EXAM-----

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS
AGE 552: AGRICULTURAL EXTENSION EDUCATION

TIME: THREE (3) HOURS

TOTAL MARKS: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS.

ALL QUESTIONS CARRY EQUAL MARKS (i.e. 20)

-
1. State the major differences between “agricultural knowledge system” and “agricultural information system” and mention at least four factors that form a basis on which farming systems research focuses on small scale farmers.
 2. Identify all “Ideal types” of adopter categories in the diffusion of innovation and for each category explain the type of farmer, advantages and disadvantages associated with working with such a farmer category.
 3. Briefly discuss the theoretical importance of objectives, target groups, offering and organization elements in the design of an extension delivery system.
 4. Based on at least four principles, show case how Participatory approach is distinguished from the Training and Visit System.
 5. “Extension methods are commonly classified into individual, group and mass media”.
 - a) Define the concept extension methods
 - b) With at least two extension methods from each of these classifications examine their suitability to learning situations.
 - c) Explain with practical examples three main reasons why group extension methods are considered to be more rewarding compared to individual methods.

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2010/2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGE 572: AGRICULTURAL POLICY ANALYSIS

TIME: THREE HOURS

INSTRUCTIONS: Answer all questions

1.
 - a) The current National Agricultural Policy for Zambia comes to an end in 2015. You have been tasked to advise on the best approach in formulating a policy for the agriculture sector. Explain and illustrate by use of a diagram your understanding regarding the definition of policy and your advice regarding the basic framework/approach that should underpin the determination of policy position in the agricultural sector. (8 marks)
 - b) The allocation of scarce resources among alternative end uses is a basic problem facing all sectors of the economy including agriculture. With the use of the production possibility frontier diagram explain the implications of choices of allocation for an economy producing wheat and rice including the following:
 - Quantity of land, labour and other inputs;
 - Possible changes in consumer tastes for the two goods;
 - Administered prices for the goods by a marketing agency such as Food Reserve Agency (FRA);
 - Possibility of achieving economic growth especially for LDCs like Zambia.(12 marks)
2.
 - a) The government may be justified to intervene in the market economy on account of market failure and on the grounds of non-efficiency reasons. What other reasons that have been advanced for intervention in the market economy? (10 marks)
 - b) Describe the possible effects of market failure due existence of monopoly power. (10 marks)
3.
 - a) Policy Analysis Matrix (PAM) is a computational framework for measuring input use efficiency in production, comparative advantage and the degree of government interventions. Describe briefly the steps followed in the construction of PAM. (12 marks)
 - b) Explain briefly some of the cautionary considerations that should be taken into account in the application of the PAM approach. (8 marks)

4. a) What is pan-territorial pricing policy? Discuss briefly the implications of this policy on regional comparative advantages and the arguments that have been advanced in support of pan-territorial food crop pricing. (10 marks)
- b) A strategic reserve can be a particularly heavy fiscal drain if the staple food crop is procured at a pan-seasonal price and is a "switch crop". Explain and illustrate by use of a diagram the possible loss and cost of grain reserve with trade when grain is procured at a pan-seasonal price and is a "switch crop". (10 marks)
5. Write short notes on the following:
- a) Pecuniary externalities: the economies of agglomeration (4 marks)
 - b) Price policies and non-price policies (3 marks)
 - c) The choice and application of policy instruments (6 marks)
 - d) Food supply insecurity and food consumption insecurity (4 marks)
 - e) Private sector contribution to agricultural research (3 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2010 ACADEMIC YEAR SECOND SEMESTER FINAL
EXAMINATION

AGF 332 METHODS IN FOOD ANALYSIS I

TIME: **Three (3) Hours**

- **INSTRUCTIONS:** Answer **any four** questions in this examination paper. Questions carry equal marks.
-

Question 1

- (a) Describe the mechanism of absorption of radiation by a molecule or atom in a food sample.
- (b) A peptide was admitted to a high resolution Mass spectrometer and the parent peak mass were measured relative to the parent peak in the spectrum of dibromobenzene (236.8638). The measured ratio of unknown mass/reference mass was 1.001197 ± 0.000002 . Compute the exact weight of the peptide.
[$^{12}\text{C} = 12.0000$; $^1\text{H} = 1.0078$; $^{14}\text{N} = 14.0031$; $^{16}\text{O} = 15.9949$; $\text{Br} = 78.9184$]
- (c) Discuss in detail the types of mobility and factors that cause mobility of food solutes in capillary electrophoresis.
- (d) You need to determine the concentration of an analyte in a food using UV/visible spectroscopy. At what wavelength would you analyze the sample and what precautions would you take when determining the concentration of the analyte?
- (e) Explain the theory and instrumentation of phosphorimetry. Mention few applications of this technique.

Question 2

- (a) What is Electroosmotic Flow in Capillary Electrophoresis (CE) and how does it arise?
- (b) Briefly outline Job's Method for the determination of the stoichiometry of a coloured food complex.
- (c) Predict the relative shape of nuclear magnetic resonance (NMR) spectrum for
 - (i) 2-butanone (methyl ethyl ketone).
 - (ii) Methyl butyrate (methylbutylester)
 - (iii) 4,4-Dimethyl-2-pentanone

- (d) A solution containing a mixture of tetracycline and epitetracycline was found to have an absorbance of 0.670 at 254nm and 0.720 at 267nm ($b=1.00\text{cm}$). If the molar Absorptivities of tetracycline are 16000 at 254nm and 19000 at 267nm and the molar Absorptivities of epitetracycline are 16000 at 254nm and 15000 at 267nm, calculate the concentrations of tetracycline and epitetracycline in the mixture.
- (e) Mass spectrometry used to be limited to the analysis of small volatile molecules. Today its major use is the analysis of large molecules, very often proteins or nucleic acids. There are several ways to make large molecules 'volatile'. Select one approach and describe how it works.

Question 3

- (a) Sketch the instrumentation for a Capillary Electrophoresis (CE) system.
- (b) How many possible orientations do spin $\frac{1}{2}$ nuclei have when they are located in applied magnetic field?
- (c) In a capillary electrophoresis system, the protein horse heart myoglobin (MW 13,900) has electrophoretic mobility μ_{ep} of $0.65 \times 10^{-4} \text{ cm}^2/\text{Vs}$ in a pH 8.5 buffer and its diffusion coefficient $D_m = 1 \times 10^{-6} \text{ cm}^2/\text{s}$ at 30,000 V. Calculate the number of theoretical plates for the protein on this system.
- (d) What is the chemical shift of a proton whose NMR signal is observed at 430 Hz down field from TMS in a spectrometer whose basic resonance frequency for hydrogen is 75MHz.
- (e) Sulphate in natural waters is often analyzed by using the barium sulphate turbidimetric method. The dissolved sulphate is reacted with a solution containing excess barium chloride to form the barium sulphate suspension. The turbidity measurements are made in a spectrometer at 450nm. The percent transmittance of a series of standards and the unknown are listed in the following table. Calculate the turbidance of each solution and the concentration of the unknown.

Sulphate concentration, mg/litre	Percent transmittance
10.2	94
19.8	80
32.2	60
45.1	40
65.6	20
79.6	13
Unknown	34

Question 4

- (a) What is the function of the electrostatic sector in a double-focusing mass analyzer? Explain its role in improving the resolution obtained with a magnetic sector mass analyzer.
- (b) A substance containing only C, H and O has a spectrum with the parent peak at m/e 184 (10%), another peak at m/e 91 (100%) and two small peaks at m/e 77 and 65. Metastable peaks appear at m/e 45.0 and 46.3.
 - (i) What are the parent and daughter ions associated with the two metastable peaks?
 - (ii) What group does the peak at m/e 77 suggest?
 - (iii) Suggest the possible structure of the compound.
- (c) Describe the process of *electro-osmosis* (also called *cathodal drift*) and explain why it is important in capillary electrophoresis.
- (d) A proton has resonance 90 Hz down field from tetra methyl silane (TMS) when the field strength is 14100 gauss and the oscillator frequency is 60 MHz. what will its shift in Hz be if the field strength is increased to 28200 gauss and the oscillator frequency to 120 MHz?
- (e) When performing UV spectroscopy, what is the effect of increasing the wavelength bandwidth (by increasing monochromator slit width) on sensitivity and specificity?

Question 5

- (a) Describe briefly three spectrophotometric methods for the evaluation of the stoichiometry of a coloured food complex.
- (b) Outline the apparatus and procedure typically used for separation of analytes by gel electrophoresis.
- (c) The absorbances of a series of standard solutions of a compound were measured; they are recorded below. The absorbance of an unknown solution of the same compound was 0.480. Determine the concentration of the unknown.

Concentration, $\times 10^{-4} \text{M}$	Absorbance
1.0	0.080
3.0	0.232
5.0	0.379
7.0	0.524
9.0	0.672
11.0	0.820

- (d) You are performing HPLC and your stationary phase is a polar nonionic functional group. What type of chromatography is this and what could you do to increase the retention time of an analyte?
- (e) In mass spectrometry, we may use electron impact ionisation or a soft ionisation method (eg chemical ionisation). What are the advantages and disadvantages of electron impact ionisation over a soft ionisation method?

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2010/2011 ACADEMIC YEAR. SECOND SEMESTER FINAL EXAMINATIONS

AGF352 FOOD MICROBIOLOGY - THEORY

TIME: THREE (3) HOURS

INSTRUCTIONS:

ANSWER ALL QUESTIONS

1. Explain the following terms briefly (in 5 lines)

- I. F value
- II. Botulism
- III. Halophilic bacteria
- IV. Facultative anaerobes
- V. MAP
- VI. Pascalization
- VII. Monod equation
- VIII. Thermophiles
- IX. Hurdle effect
- X. Aflatoxins
- XI. Spongiform encephalopathies
- XII. CCP

(20 Marks)

2. Microorganisms are used positively in the processing of fermented foods.

- I. State the function of microorganisms in fermented food products, giving examples.
- II. From the choice of a fermented food, State the type of microorganisms used in the chosen food product.

(20 Marks)

3. Describe in detail the Intrinsic Factors that affect the growth of microorganisms.

(30 Marks)

4. Describe in detail how the following processes effect food preservation

- I. Organic acids
- II. Sodium Chloride
- III. Freezing
- IV. Ionising radiation

(30 Marks)

GOOD LUCK

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

2009/10 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS

AGF 352 / BS 482: FOOD MICROBIOLOGY
TIME: THREE HOURS

INSTRUCTIONS:

The examination has two sections, **A** and **B** and questions in both sections carry equal marks.

There are a total of **SIX** questions; answer **FIVE** questions, all the **THREE (3)** questions in section **A** and **TWO (2)** in section **B**

Section A

1.
 - a. Explain **in detail** the effects of **pH** and **Eh** (Oxidation-Reduction Potential) on spoilage of meat and meat products **(16 Marks)**
 - b. Describe **two (2)** processing factors in the meat industry that would contribute to meat spoilage **(4 Marks)**
2. Describe **briefly** how each of the following food preservation methods destroy microorganisms
 - a. Irradiation **(4 Marks)**
 - b. Carbon dioxide (CO₂) and Ozone (O₃) **(4 Marks)**
 - c. Phosphates and nitrates **(4 Marks)**
 - d. Sodium Chloride and Sugars **(4 Marks)**
 - e. Fermentation **(4 Marks)**
3. You have been appointed to manage the catering of a newly opened Boarding High School and are trying to come up with a cleaning and disinfection program for the school cafeteria.
 - a. Why should cleaning and disinfection procedures be considered integral to any food establishment? **(4 Marks)**
 - b. Outline the basic steps involved in the cleaning and disinfection procedures. **(4 Marks)**
 - c. Describe **two (2)** factors that would influence the cleaning procedure to be carried out. **(4 Marks)**
 - d. List two chemical sanitizers that you would consider to use for disinfection and for each give **one (1)** advantages and **one (1)** disadvantage. **(4 Marks)**
 - e. Explain why it is difficult to destroy biofilms during cleaning and disinfection in a food establishment **(4 Marks)**

Section B

4. Describe **in detail** contamination and spoilage of the following
- a. Fish (10 Marks)
 - b. Grain and grain products (10 Marks)
- 5.
- a. In the implementation of a HACCP Plan, describe **in detail** the first five (5) steps and their importance (15 Marks)
 - b. Name two biological, two chemical and two physical hazards that may be associated with food and food products. (3 Marks)
 - c. Identify one limitation of HACCP (2 Marks)
6. Write short notes on the following
- a. Bovine Spongiform Encephalopathy (BSE) (5 Marks)
 - b. Listeriosis (5 Marks)
 - c. Mechanism of intoxication by *Clostridium perfringens* (5 Marks)
 - d. Control of food intoxication and food infection (give at least five reasoning) (5 Marks)

END OF EXAMINATION

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

AGF 362: FOOD EVALUATION

EXAMINATION: Second Semester, May 2011

TIME: Three (3) Hours

INSTRUCTIONS:

- (i) There are five questions in this paper. **Question 1 is compulsory.** Out of questions 2 to 5, answer **any three** questions.
 - (ii) All questions carry **20 marks** each
 - (iii) Find also attached **table T4** – Upper α -probability points of student's t-distribution, **table T5** – Upper α -probability points of χ^2 -distribution and **table T6**-Upper α -probability points of F-distribution
-

QUESTION 1 (Compulsory)

A peanut butter manufacturer plans to improve the spreadability of their peanut butter. You as a hired Product Researcher has proposed two (2) prototypes of peanut butter which you label as sample PB1 and sample PB2. The two prototypes have shown that they are more spreadable than the regular peanut butter (control). Sample PB1 requires more force to initiate spreading while sample PB2 initially spreads easily but reduces spreadability subsequently. The manufacturer wishes to know how different the prototypes are from the regular peanut butter (control) as perceived by his/her consumers. In order to achieve this, you as a product researcher decided to carry out a sensory evaluation test. A pre-weighed amount of peanut butter is placed in a cup. The same amount is weighed out for each sample. The test is performed by evaluating the spreadability of the peanut butter on a piece of biscuit previously proven to have the same surface smoothness for all pieces. The evaluation is limited to two samples at a time. All panelists receive the labeled control first and the test (prototype) sample second. The test uses 10 panelists who evaluate all the three possible pairs, which may be:

- Control vs product PB1
- Control vs product PB2
- Control vs Blind Control

The results obtained are shown in the table below.

Panelist	Blind Control	Prototype PB1	Prototype PB2
1	1	4	5
2	4	6	6
3	1	4	6
4	4	8	7
5	2	4	3
6	1	4	5
7	3	3	6
8	0	2	4
9	6	8	9
10	7	7	9

- State with reason(s) what kind of sensory test you carried out to obtain this kind of data [2 marks]
- Are the prototypes, sample PB1 and sample PB2, significantly different from the regular peanut butter, (blind control sample)? [5 marks]
- Which sample is significantly more different from the regular peanut butter, sample PB1 or sample PB2? [5 marks]
- Did the panelists show significant differences in their scores? [5 marks]
- What decision(s) can you as a product researcher advise the peanut butter manufacturer to make from these results? [3 marks]

NOTE: $LSD = t \cdot \sqrt{2 \cdot MS_E / n}$

where t is the t-value for the level of significance of the ANOVA, $\sqrt{}$ = Square root, MS_E = Error Mean Square for the ANOVA and degrees of freedom being equal to the degrees of freedom of the error term (df_E).

QUESTION 2

- Define the following terms:
 - Organoleptic [1 mark]
 - Discrimination [1 mark]
 - Nominal data [1 mark]
 - Augesia [1 mark]
 - Absolute threshold [1 mark]
- We tend to perceive the attributes of a food item in the following order
 - Appearance [1.5 marks]
 - Aroma/fragrance [1.5 marks]
 - Consistency/texture [1.5 marks]
 - Flavor [1.5 marks]

For each term, define it and give three (3) sub-attributes which can be defined under each given attribute

- (c) Give four (4) applications of descriptive analysis in sensory evaluation [4 marks]
- (d) In the Duo-trio-test, two forms of the test exist. Mention the two and explain the difference between the two forms of the test? [5 marks]

QUESTION 3

- (a) State three differences between the following pairs;
- (i) Kinesthetic and somesthetic perceptions? [1.5 marks]
 - (ii) Gustation and trigeminal perceptions? [1.5 marks]
- (b) Briefly, describe how you would perform each of the following overall difference tests. Also explain how you would analyze the data from such tests:
- (i) Triangle test [2 marks]
 - (ii) Two-out-five test [2 marks]
- (c) Give and briefly describe three (3) major types of qualitative affective tests [6 marks]
- (d) (i) Mention and briefly describe three ways in which you can determine color of food for the purpose of research, quality control or commerce [1.5 marks]
- (ii) Two egg yolks were measured for color using a Minolta color meter at UNZA-Food Science Laboratory. The two egg yolks gave the following CIELAB values,
- Egg Yolk A: $L=43.3$, $a=30.0$ and $b=40.0$
- Egg Yolk B: $L=75.3$, $a=45.1$ and $b=58.4$
- Using the CIELAB-values of the two egg yolks given, show by description the difference in the colour likely to be perceived on the two egg yolks [4 marks]
- (iii) Mention and explain three pieces of information you can obtain from a texture profile curve [1.5 marks]

QUESTION 4

Eight panelists assessed for a single quality attribute on a new maheu product on a given scale. Each panelist retested the new maheu on six successive days (six replications). The panelists involved in the sensory evaluation were Abel, Bob, Cynthia, Derick, Emery, Fordson, Gibbson and Harriate. Each of the panelists scored: 7, 4, 6, 9, 8 and 6; 6, 3, 5, 7, 8 and 7; 5, 7, 8, 8, 7 and 7; 6, 8, 8, 6, 7 and 6; 7, 6, 8,

5, 6 and 5; 8, 5, 7, 7, 9 and 6; 7, 7, 7, 8, 7 and 5; and, 6, 8, 6, 7, 7 and 5. Assume the scores to come from normally distributed data and having come from populations with the same variance.

- (a) Was the overall performance of the panelists significantly different? [5 marks]
- (b) Which panelists scored differently? [3 marks]
- (c) Was the panel consistent over replications? [5 marks]
- (d) Identify the sets of replications which are different? [3 marks]
- (e) Would you recommend for the continuous use of this panel? Explain your answer [4 marks]

QUESTION 5

New investors in Zamanita (Zambia) intend to modernize the cooking oil plant by replacing an old solvent extraction equipment with a new model. The Plant Manager would like to know if the cooking oil produced in the new extraction equipment (**Cooking oil B**) is the same as that made in the old solvent extraction plant (**Cooking oil A**). The original, cooking oil A, has a slight beany flavour which has a carryover effect. In previous market surveys it was, however, proven that the consumers like this slight beany flavour. The Plant Manager hires you as a Sensory Evaluation Consultant. The Plant Manager would like you to determine if the two types of cooking oil produced by the two solvent extraction equipment can be distinguished by flavour. Secondly, the Plant Manager would like you to determine if the new solvent extraction equipment can be used in place of the old solvent extraction equipment. To provide the Plant Manager with the information to his queries, you conducted a sensory test. In this sensory test, you obtained a total of 60 responses, 30 matched pairs and 30 unmatched pairs, collected from 60 panelists. Each panelist evaluated either a matched pair (cooking oil A/cooking A or cooking oil B/cooking oil B) or unmatched pair (cooking oil A/cooking oil B or cooking oil B/cooking oil A) in a single session. The sensory test was conducted in the booth area under red lights. For the matched pairs, 17 panelists said the samples were the same and 13 panelists said the samples were different. On the other hand, in the unmatched pairs, 9 panelists said the samples were the same and 21 panelists said the samples were different.

- (i) State with reason(s) what kind of sensory test you carried out to obtain this kind of data [3 marks]
- (ii) Why was the test performed under red light? [2 marks]
- (iii) Give advice, outlining your basis, to the Plant Manager regarding his two queries above [12 marks]
- (iv) In your opinion, what decision is the Plant Manager likely to make? [3 marks]

.....**End of Examination**.....

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

AGF 342: FOOD TOXICOLOGY

EXAMINATION: Second Semester, May 2011

TIME: Three (3) Hours

INSTRUCTIONS:

- (i) There are five questions in this paper. Answer any four questions of your choice.
- (ii) All questions carry **20 marks** each

QUESTION 1

(a) Define the following terms and state their importance in food toxicology

- (i) Food intoxication [2 marks]
- (ii) Mutagen [2 marks]
- (iii) LD₅₀ [2 marks]
- (iv) Systemic exposure [2 marks]
- (v) Pandemic disease [2 marks]

(b) There are number of structural barriers in existence in human beings that restrict entrance of toxicants into certain organs or tissues. State and explain three important examples of structural barriers to toxicants in human beings [10 marks]

QUESTION 2

- (a) (i) In the growth of the fetus or embryonic cells, which stage is considered the critical or highly susceptible stage with regard to teratogenesis? [1 mark]
- (ii) What makes the stage you have mentioned critical, explain? [2 marks]
- (b) In cytotoxic teratogenesis, malformations involve reduction deformities, or missing elements. Why is this plausible for this mechanism? [2 marks]
- (c) The transformation of normal cells into cancerous cells, also known as carcinogenesis, is considered to proceed through at least three phases or stages
 - (i) State and explain each stage [4 marks]
 - (ii) Which stage could be targeted for chemotherapy, and why? [1 mark]
- (d) (i) Give and explain three approaches to cancer therapy [3 marks]
- (ii) State one problem associated with the use of each of the approaches mentioned [2 marks]
- (e) (i) State and explain three approaches to study or understand teratogenesis [3 marks]
- (ii) Why is it important for the scientists to study and understand teratogenesis? [2 marks]

QUESTION 3

- (a) What is the difference between food allergy and food intolerance [3 marks]
- (b) (i) State and explain four categories of microorganisms in terms of their use in food technology [6 marks]
- (ii) Which category is important for food toxicology and why? [2 mark]
- (c) (i) What are mycotoxins? [2 marks]
- (ii) What do you understand by aflatoxins and discuss their importance in food toxicology [4 marks]
- (iii) State and explain two of the important factors determining aflatoxin's presence in stored foods [3 marks]

QUESTION 4

The compounds stated below may be found in foods. Write short notes on important toxicological aspects about these compounds.

- (a) PAHs [5 marks]
- (b) Acrylamides [5 marks]
- (c) Cyanogens [5 marks]
- (d) Scombroid poisoning [5 marks]

QUESTION 5

- (a) Mention three major routes of exposure due to accidental or intentional exposure of humans to toxicants? [3 marks]
- (b) Out of these, select one which is considered to be a more important route to food toxicology and give details of how the different parts of this selected route determines the proportion of toxicant that could be absorbed into the blood stream? [17 marks]

.....*End of Examination*.....

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

AGF 342: FOOD TOXICOLOGY

EXAMINATION: Second Semester, May 2011

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- (iv) Systemic exposure [2 marks]
- (v) Pandemic disease [2 marks]

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.....*End of Examination*.....

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2010/2011 ACADEMIC YEAR. SECOND SEMESTER FINAL EXAMINATIONS

AGF352 FOOD MICROBIOLOGY - PRACTICAL

TIME: THREE (3) HOURS

INSTRUCTIONS:

ANSWER ALL QUESTIONS

ALL THE QUESTIONS CARRY EQUAL MARKS (I.E 50 MARKS)

1. As Quality Control Manager of a Dairy processing plant, you have just finished designing and implementing a HACCP plan for a "Yoghurt with Peanuts" processing line.
- (i) Give and explain the 7 principles of HACCP you utilized during the implementation.
- (ii) Give a brief process flow diagram for the production of the "Yoghurt with Peanuts" and identifying CCP's.
- (iii) Based on the identified CCP's, please create a HACCP data sheet (as provided below)

Process Step	Hazards (What can go wrong here)	Control (What can I do about it)	Critical Control (Is it critical to food safety)	Monitoring (How can I check)	Limits (What time or temperature must be achieved)	Corrective Actions (What if its not right)	Review (How often should I review the system)

(50 Marks)

2. You are provided with a food sample labeled **X** that is compromised in its microbiological quality.
- I. Describe how you would isolate and quantify the hygiene indicator microorganisms from the provided food sample.
 - II. Comment on the intrinsic factors in the food sample that may inhibit the proliferation of the spoilage microorganisms.
 - III. Comment on one possible pathogenic microorganism that is likely to inhabit the provided food product and how it brings about food poisoning and the related symptoms from the food poisoning.

(50 Marks)

GOOD LUCK

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

**2010/2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGF 422 NUTRITION.

TIME: THREE (3) HOURS

INSTRUCTIONS

ANSWER ALL QUESTIONS IN SECTION A AND ANY 2 FROM SECTION B
EACH QUESTION CARRIES 20 MARKS
ANSWER EACH QUESTION IN SECTION B IN A SEPARATE ANSWER BOOKLET

SECTION A

QUESTION 1

Briefly explain the following

- i. Rickettes
- ii. Hypertension
- iii. Type II diabetes
- iv. Vitamin K.
- v. Thiamin
- vi. BMR
- vii. Cephalic phase
- viii. Activated Transport
- ix. Lipoproteins
- x. BMI
- xi. Hypercholesterolemia

(20 Marks)

QUESTION 2

State (with examples and brief explanations) the functions of the following;

- i. Vitamin A
- ii. Minerals
- iii. Large intestines
- iv. Calcium

(20 Marks)

QUESTION 3

Explain the role of lipids in diet and in the body.

(20 Marks)

SECTION B

QUESTION 4

The outcome of over nutrition in Zambia is being indicated through the prevalence of overweight and obesity in Zambia. As a consultant you have been tasked to explain the probable causes of overweight and obesity in Zambia.

(20 Marks)

QUESTION 5

Iron deficiency is a major public health problem, affecting women and children in Zambia. Describe how iron is absorbed/ balanced in the body and discuss the major factors influencing the bioavailability of iron.

(20 Marks)

QUESTION 6

Whole wheat bread (Fiber, Starch and lactose) is being recommended as a health food for certain individuals in the population.

- I. Briefly explain the process of digestion and absorption/transport (after digestion) of whole wheat bread upon consumption.
- II. What are the possible health benefits (disease prevention) that can be associated with the consumption of this food?

(20Points)

QUESTION 7

You are a nutritionist at a primary health facility (With a doctor and paediatric ward) in peri-urban area and a mother presents a child with severe PEM.

What clinical signs are you likely to observe?

What treatment regime would you recommend for the full recovery of the infant

(20 Points)

GOOD LUCK!!!!

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

2010/11 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATION

AGF 432: PROCESS CONTROL AND INSTRUMENTATION

TIME: THREE HOURS

INSTRUCTIONS:

1. Carefully read the instructions and each question.
 2. Answer **ALL** questions.
 3. **ALL** questions carry equal marks.
 4. Table of Laplace transformations is provided on the last page.
-

1. A mercury thermometer having a first-order dynamics with time constant is placed in a bath at a certain temperature until it reaches steady state.
 - a) Derive the first-order dynamic model for a mercury thermometer in the bath. [10 marks]
 - b) Draw a sketch showing the variation of the thermometer reading with time. [5 marks]
 - c) Outline the differences between the negative feedback and positive feedback systems, and of these two is the most preferred system in food processing. [5 marks]
2. Consider a liquid-level system of a water treatment tank of a cross section area, flow resistance R . assume that q_0 , the volumetric flow through R is related to the head h by $q_0 = h/R$. constant density ρ .

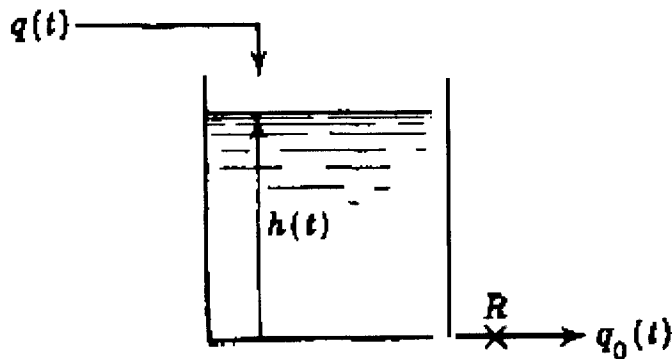


Figure 1

- a) State the conservation law of mass. [5 marks]
 - b) Develop the process model for the system. [10 marks]
 - c) Determine the transfer control function. [5 marks]
3. The bottling processes of producing *CocaCola* involve mixing of a concentrate, pure sugar, treat water, carbon dioxide in correct proportion. Assume a stream of sugar flows at constant volumetric flow rate q into a tank of constant hold up volume V . concentration of sugar entering the stream, χ (mass.sugar/vol) varies with time.

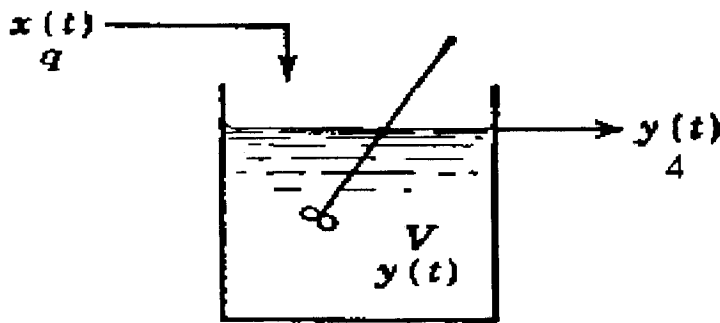


Figure 2.

- a) Determine the transfer function relating outlet concentration γ to inlet concentration χ . [5 marks]
- b) Determine the process model given that the input is a unit step function. [5 marks]
- c) Provide the block diagram for each of the following control functions:

$$\text{i. } \frac{Y(s)}{U(s)} = G(s)$$

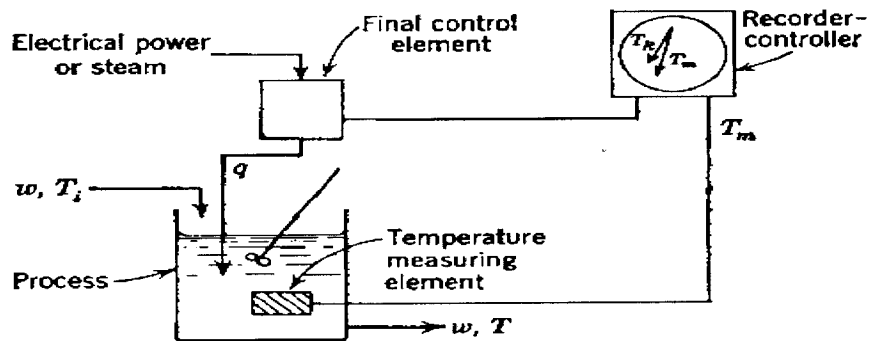
$$\text{ii. } \frac{Y(s)}{U(s)} = G_1(s)G_2(s)G_3(s)$$

$$\text{iii. } \frac{Y(s)}{U(s)} = G_1(s) + G_2(s)G_3(s)$$

$$\text{iv. } \frac{Y(s)}{U(s)} = \frac{G_1(s)G_2(s)}{1 + G_1(s)G_2(s)}$$

[10 marks]

4. The diagram below shows the control system of the higher order.



- Draw the block diagram representing the control system above. [5marks]
- Describe how the error is generated and controlled. [3 marks]
- State the unsteady state balance of the system. [1 marks]
- State the steady state balance of the system. [1 marks]
- Determine the transfer function and describe how the system operates. [10 marks]

5. The R&D department of the company you are working for is trying to develop a new concentrated mango juice by blending a pure component A and a mixture of (A and B) using a stirred tank blending system as shown in figure 1.3 below. The following notions are used:

- w_1, w_2 and w are mass flow rates
- x_1, x_2 and x are mass fractions of component A.

It is assumed that:

- w_1 is constant,
- $x_2 = \text{constant} = 1$ (stream 2 is pure A),
- Perfect mixing in the tank.

Your control objective is to keep x of the product coming out of the blender at the desired value (or 'set point') x_{sp} , despite variations in x_1 . flow rate w_2 can be adjusted for this purpose.

- What value of w_2 is required to have $x = x_{sp}$? [7 marks]
- Outline the possible control strategies for the system. [5 marks]
- Categorize these strategies so that the management can easily understand them during your presentation in the management meeting. [5 marks]
- Which of the variable in the system would be considered as a disturbance or load variable? [3 marks]

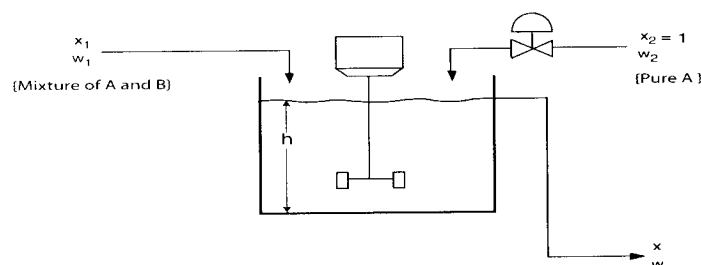


Figure 1.3. Stirred-tank blending system.

Annex: Laplace Transforms

	Functions of time, $f(t)$	Laplace Transforms of $f(t)$, $L\{f(t)\}$
1	$f(t)$	$F(s)$
2	$x(t) + y(t)$	$X(s) + Y(s)$
3	$k f(t)$	$k F(s)$
4	$\frac{d}{dt} f(t)$	$sF(s) - f(0)$
5	$\frac{d^2}{dt^2} f(t)$	$s^2 F(s) - s f(0) - f'(0)$
6	$\int_0^t f(\tau) d\tau$	$\frac{F(s)}{s}$
7	1	$\frac{1}{s}$
8	t	$\frac{1}{s^2}$
9	e^{-at}	$\frac{1}{(s+a)}$
10	te^{-at}	$\frac{1}{(s+a)^2}$
11	$1 - e^{-at}$	$\frac{a}{s(s+a)}$
12	$f(t-a), t > a$	$e^{-as} F(s)$

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

**2010/2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

FOOD PACKAGING AGF 442

TIME: THREE (3) HOURS

INSTRUCTIONS

**ANSWER ALL QUESTIONS.
EACH QUESTION CARRIES 20 MARKS**

1. Food packaging has many definitions one of which states that: "Food packaging (packaging for food) is a means of achieving safe delivery of products in sound condition to the final user at a minimum cost".
 - a) In your own opinion, who needs food packaging in the food chain? **(10 marks)**
 - b) According to head and Stewart (1989), explain the factors that influence the success of a package in advertising? **(4 marks)**
 - c) Explain the levels of packaging. **(3 marks)**
 - d) Classify packaging based on migration. **(3 marks)**
2. The food industry uses four basic materials for food packaging namely: metal, glass, plastic and plant matter.
 - a) Name the basic types of metal cans based on method of construction. **(2 marks)**
 - b) Give two methods used for manufacturing paper. **(2 marks)**
 - c) State the special requirement necessary for paper that comes into contact with foods. **(2 marks)**
 - d) State the major safety concern of using paper as a packaging material. **(2 marks)**
 - e) Give two problems that are associated with absorption of flavor components by packaging materials. **(4 marks)**
 - f) Give a complete scenario of product-package interaction resulting from several modes. **(8 marks)**
3. A food company dealing with the manufacture of chocolate is looking for an ideal packaging material to package the chocolates and have come to you for advice.
 - a) Write a report on what you think should be the best packaging material for the product and give reasons. **(10 marks)**
 - b) Explain two defects that are usually associated with chocolates. **(3 marks)**
 - c) List the five modes of deterioration to be considered when selecting suitable packaging materials for breakfast cereals. **(5 marks)**

d) State the two major modes of deterioration to be considered when packaging fried snack foods? **(2 marks)**

4. Governments worldwide regulate foods with two general objectives which are to ensure the safety and wholesomeness of the food supply, hence the health of the public and to prevent economic fraud or deception i.e. food adulteration.

a) Give five situations that make a food to be considered adulterated. **(5 marks)**

b) Give three requirements of food additives. **(3 marks)**

c) What are the three types of information found on a food package label? **(3 marks)**

d) Define is plastic recycling. **(2 marks)**

e) Plastic polymers require greater processing to be recycled when compared to other materials like glass and metal materials. Give reasons for this. **(3 marks)**

f) Explain why plastics are sorted out according to their polymer types before recycling. **(4 marks)**

5. Aseptic technology results in production of ambient-shelf stable foods.

a) Define aseptic technology. **(3 marks)**

b) Discuss the factors that should be considered in order for aseptic packaging to be successful. **(15 marks)**

c) Which gas is not used in MAP despite having good effects and give reasons. **(2 marks)**

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2010 ACADEMIC YEAR SECOND SEMESTER FINAL
EXAMINATION

AGF 452 METHODS IN FOOD ANALYSIS II

TIME: **Three (3) Hours**

INSTRUCTIONS: Answer **any four** questions in this examination paper. Questions carry equal marks.

Question 1

- (a)
 - (i) How can you remove oxygen from the polarographic cell and why?
 - (ii) Explain how convective and electrostatic attractions are minimized in polarography.
- (b) Briefly explain the roles of the working, counter and reference electrodes in potentiostatic electrolytic cell.
- (c) 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 $2.31\mu\text{A}$. when $50.0\mu\text{L}$ of 100ppm zinc standard was added to this solution, the current was $2.99\mu\text{A}$. What is the concentration of zinc in the cereal?
- (d) A 0.3619g sample of tetrachloropicolinic acid, $\text{C}_6\text{HNO}_2\text{Cl}_4$, is dissolved in distilled water, transferred to a 1000mL volumetric flask, and diluted to volume. An exhaustive controlled-potential electrolysis of a 10.00ml portion of this solution at a spongy silver cathode requires 5.374C of charge. What is the value of n for this reduction reaction?

Question 2

- (a) Ion selective electrode and reference electrode pair was placed in exactly 100ml of the sample; a reading of 21.6mV was obtained. After the addition of exactly 10ml of a standard solution with a concentration of $100\mu\text{g/ml}$, the electrode pair reading gave a reading of 43.7mV. The response slope of the indicator electrode was previously determined to be 57.8mV. What is the sample concentration?

- (b) An unknown amount of copper (II) ions in a food sample produces a faradic current of $12.3\mu\text{A}$ on a normal pulse voltammogram. After 0.100ml of $1.0 \times 10^{-3}\text{M}$ Cu^{2+} is added to the original volume of 5.00ml , the new current is $28.2\mu\text{A}$. Calculate the original amount of copper in the food sample.
- (c) The purity of a sample of $\text{Na}_2\text{S}_2\text{O}_3$ was determined by a coulometric redox titration using I^- as a mediator, and I_3^- as the 'titrant'. A sample weighing 0.1342g is transferred to a 100ml volumetric flask and diluted to volume with distilled water. A 10.00ml portion is transferred to an electrochemical cell along with 25ml of 1M KI , 75ml of $\text{pH } 7.0$ phosphate buffer, and several drops of a starch indicator solution. Electrolysis at a constant current of 36.45mA required 221.8s to reach the starch indicator end point. Determine the purity of the sample.
- (d) What is the short wavelength limit for a 60kV X-ray tube? What is the atomic number of the element for which just insufficient energy is available for excitation? Given: $I = 120.96$ units, $i = 500\text{mA}$, $k = 9.6 \times 10^{-7}$.

Question 3

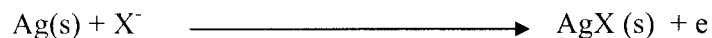
- (a) A 0.40g sample of toothpaste Colgate was suspended in 50ml of fluoride ionic strength buffering medium (TISAB), and boiled to extract the fluoride. The mixture was cooled, transferred quantitatively to a 100ml volumetric flask and diluted to volume with deionised water. A 25.0ml aliquot was transferred to a beaker; a fluoride ISE and reference electrode inserted and a potential of -155.3mV was obtained after equilibration. A 0.100ml spike of 0.5mg/ml fluoride stock solution was added after which the potential was -176.2mV . Calculate the percentage of F^- by weight in the original toothpaste sample.
- (b) Calculate the potential of half cell of copper which is immersed to the 0.05M CuSO_4 . Standard potential $E^\circ \text{Cu}^{2+}/\text{Cu} = 0.337\text{V}$ and $t = 25^\circ\text{C}$ ($a_{\text{H}}=1$)
- (c) In coulometric titration of Fe^{2+} with Ce^{4+} which were generated at the cathode. The resistance was $R = 150\Omega$, potential was 0.705V and the end point was reached after 352 seconds. Calculate the amount of iron in μg .
- (d) Calculate the relative decrease of concentration of zinc in %, after electrolysis on the drop mercury electrode which lasted 17 minutes. Suggest that current during electrolysis is constant. Given that: $m = 2.6 \times 10^{-3}\text{g/s}$, $t = 2.3\text{s}$, $D = 0.95 \times 10^{-5}\text{cm}^2/\text{s}$, $C = 2.5 \times 10^{-4}\text{M}$ volume is 15ml ($3.75 \times 10^{-2}\text{mmol/l}$ in 15ml or $3.75 \times 10^{-5}\text{mol/L}$).

Question 4

- (a) 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. State with reasons the type of preferred atomic spectroscopy you would use.
- (b) 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 0.002414M benzoic acid solution is found to be 32.22 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°_+	Anions	λ°_-
H ⁺	349.8	OH ⁻	198.6
Na ⁺	50.1	Cl ⁻	76.4
Ca ²⁺	59.5	Acetate	40.9
Mg ²⁺	53.1	Benzoate	32.4

- (c) Ions that react with Ag⁺ can be determined electrogravimetrically by deposition on a silver anode:



- (i) What will be the final mass of a silver anode used to electrolyze 75.00ml of 0.02380M KSCN if the initial mass of the anode is 12.4638g?
- (ii) At what anode potential versus SCE cathode will 0.10M Br⁻ be deposited as AgBr(s)?
- (d) 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 attractions are minimized.

Question 5

- (a) The concentration of Ca^{2+} in a sample of sea water is determined using a Ca ion-selective electrode and a one-point standard addition. A 10.00-mL sample is transferred to a 100-mL volumetric flask and diluted to volume. A 50.00-mL aliquot of sample is placed in a beaker with the Ca ion-selective electrode and a reference electrode, and the potential is measured as -0.05290 V. A 1.00-mL aliquot of a 5.00×10^{-2} M standard solution of Ca^{2+} is added, and a potential of -0.04417 V is measured. What is the concentration of Ca^{2+} in the sample of sea water?
- (b) Explain how you would determine the molar conductivity at infinite dilution for a strong and weak electrolyte in a food sample.
- (c) A Zambia continues to have difficulties with infestations of fruit flies imported from other in travelers' baggage and other personal belongings. Describe the basic organization of a digital image analysis system for on-line inspection detection of fruits (apples, bananas, mangoes, etc) in suitcases as they are transported from aircraft to baggage claim carousels. (5marks)
- (d) A milk sample containing trace amounts of zinc is analyzed using an electro thermal atomic absorption spectrophotometer with a photomultiplier tube detector. A calibration sample containing 1.4ppm of zinc gives a signal of 124.5 units. If the background signal is 8.2 units and the concentration equivalent of the background is 1.02ppm, calculate the concentration of zinc in a sample that gives a signal response of 94.5 units. (6marks)

END OF EXAMINATION

PERIODIC TABLE OF THE ELEMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
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KEY

Atomic number X
Atomic mass
Name of the element X

Atomic number X Atomic mass Name of the element X																			
1 H Hydrogen 1.01	4 Be Beryllium 9.01									5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18				
3 Li Lithium 6.94										13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.99	16 S Sulphur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95				
11 Na Sodium 23.00	12 Mg magnesium 24.31																		
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.88	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.39	31 Ga Gallium 69.72	32 Ge Germanium 71.61	33 As Arsenic 74.92	34 Se Selenium 78.96				
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium 97.91	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60				
55 Cs Cesium 132.91	56 Ba Barium 137.33	57 - 71 Lanthanum Cerium Praseodymium Neodymium Promethium Samarium Europium Gadolinium Terbium Dysprosium Holmium Erbium Thulium Ytterbium Lutetium	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium 208.98				
87 Fr Francium (223.02)	88 Ra Radium 226.03	89 - 103 Francium Radium Actinium	104 Lr Lutetium 261.11	105 Lr Lutetium 262.11	106 Uub Unh 263.12	107 Uus Uns 262.12	108 Uuo Uuo 265.00	109 Uue Uue 265											
													</						

57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium 144.91	62 Sm Samarium 150.36	63 Eu Europium 151.97	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.97
89 Ac Actinium 227.03	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium 237.05	94 Pu Plutonium 244.0	95 Am Americium 243.06	96 Cm Curium 247.07	97 Bk Berkelium 247.07	98 Cf Californium 251.08	99 Es Einsteinium 252.08	100 Fm Fermium 257.10	101 Md Mendelevium 260	102 No Nobelium 259.10	103 Lr Lawrencium 262.11

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
SECOND SEMESTER EXAMINATION MAY 2011
TECHNOLOGY OF MEAT AND FISH PRODUCTS
AGF 512

- INSTRUCTIONS:
- 1) Answer all questions in both sections
 - 2) Use separate answer books for either section
 - 3) Time: 3 hours
-

Section A: Answer both questions

Question 1

- a) Discuss microbial invasion in fish and the changes in the microflora during its storage.
[10 marks]
- b) Chilling is a very important step in the handling of fish. Discuss three (3) chilling methods and give their limitations.
[10 marks]
- c) RB Supermarket Ltd sales chilled Mackerel and Tilapia. The manager approaches you with a problem of varying shelf life for the two species of fish with one being shorter than the other. As an expert in fish product technology, explain the reasons for the differences and advise the client accordingly on the actual storage life for each species. [5 marks]

Question 2

- a) Explain the freezing process of fish and the factors affecting frozen fish storage. [10 marks]
- b) Chama fisheries is experiencing the following problems on its smoked fish products:
 - short storage life
 - spoilage of the fish from inside,
 - toxic substances on the fish
 - moulds on the fishExplain the causes and offer possible solutions. [10 marks]
- c) Discuss the types of gases used in the modified atmosphere packaging (MAP) of lean and fatty fish. [5 marks]

SECTION B: Answer all questions

Question 1

- a) Nitrates are usually used in the production of cured meats. One of their major functions in cured meats is to impart a characteristic colour to the cured meat. Describe and discuss the chemistry of the cured meat colour due to the use of nitrates **[10 marks]**
- b) State the causes of stress in animals and explain how stress can contribute to production of poor quality of meat and other animal products **[10 marks]**

Question 2

- a) Define the following terms and for each, state how it affects meat quality:
- i) Rigor mortis **[2 marks]**
 - ii) Cold shortening **[2 marks]**
 - iii) Meat binders **[2 marks]**
 - iv) Yield grading **[2 marks]**
 - v) DFD **[2 marks]**
- b) What are seasonings and flavors, and what is the importance of these? What materials/substances are used as seasonings and flavorings? Seasonings are usually prone to high microbial loads, how is this treated? **[10 marks]**

Question 3

- a) Describe the structure of the myofibril. Further to this, state four of the important proteins in animal muscles and briefly how each of the four contributes to contraction of muscles. **[10 marks]**
- b) Describe the structure of comminuted meat as an emulsion? What are the stabilizing and destabilizing factors of comminuted meat? What are the signs of destabilization of comminuted meat? **[10 marks]**

End of Exam

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
SECOND SEMESTER EXAMINATION MAY 2011
TECHNOLOGY OF MEAT AND FISH PRODUCTS
AGF 512

- INSTRUCTIONS:
- 1) Answer all questions in both sections
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 - 3) Time: 3 hours
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Question 3

- a) Describe the structure of the myofibril. Further to this, state four of the important proteins in animal muscles and briefly how each of the four contributes to contraction of muscles. [10 marks]
- b) Describe the structure of comminuted meat as an emulsion? What are the stabilizing and destabilizing factors of comminuted meat? What are the signs of destabilization of comminuted meat? [10 marks]

End of Exam

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

**2010/11 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATION**

TECHNOLOGY OF FERMENTED PRODUCTS AGF 522

TIME: THREE (3) HOURS

INSTRUCTIONS

**ANSWER ALL QUESTIONS.
EACH QUESTION CARRY EQUAL MARKS**

1.
 - a. Give the objectives of the fermentation process in acid – based fermented foods.
(5 marks)
 - b. Discuss selective and elective conditions for the growth of lactic acid bacteria and explain how these conditions can be achieved.
(5 marks)
 - c. With aid of a flow diagram, describe the process of manufacturing pickled cucumbers under controlled conditions
(15 marks)

2. Koji making is an important process in the manufacturing processes of many types of oriental foods.
 - a) Explain the koji making process and compare it with its equivalent processing step in the brewhouse.
(10 marks)
 - b) With aid of a flow diagram, describe the manufacturing process of Sufu.
(10 marks)
 - c) Briefly explain the Chibwantu making process.
(5 marks)

3.

- a. Discuss the role of the Kefir grain microflora during the fermentation process of Kefir.
(10 marks)
 - b. Explain the classification of starter cultures and for each class, give an example of the type product and its respective starters.
(10 marks)
 - c. State the importance of acetaldehyde in fermented milk and explain how it is produced.
(5 marks)
4. Micheal, Chama, Gladys and Brina go to a bar to relax after writing their final examination and order hunter's gold (cider), mosi, shake-shake and rose wine, respectively. Differentiate these beverages according on their organolepic properties and production flow processes.
(25 marks)

End of Examination

GOOD LUCK!!!!

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2010/2011 ACADEMIC YEAR
SECOND SEMESTER FINAL EXAMINATIONS

AGF 532: TECHNOLOGY OF PLANT PRODUCTS II
TIME: THREE (3) HOURS

INSTRUCTIONS:

ALL QUESTIONS CARRY EQUAL MARKS.

ANSWER QUESTION ONE AND ANY OTHER IN SECTION A, AND BOTH QUESTIONS IN SECTION B.

ANSWER EACH SECTION IN A SEPARATE ANSWER BOOKLET.

Section A: Answer question one and any other

Question 1

Crude oleins have found their use as a major ingredient in salad oils and they can be obtained by a fat modification process called fractionation.

Describe in detail how the crude oleins can be obtained from refined sunflower oil by this process.

[25 Marks]

Question 2

Neutralization, in the refining of vegetable oils, is an important unit operation. Describe in detail the aim of this operation and how it can be achieved.

[25 marks]

Question 3

Soy milk production and consumption in Zambia remains a challenge as it is associated with some undesirable quality properties. What are these undesirable quality properties and how can they be minimized during soy milk processing.

[25 Marks]

Section B: Answer both questions.

Question 1

H. B. Consulting Ltd is contracted to set up a mango canning factory. You are the leading consultant of the company and because of your vast knowledge in fruit and vegetable processing, the company has given you the following tasks.

- a. Show the production process using a flow diagram, stating the importance of each step and highlight the types of equipment that will be used to manufacture this product. **[15 marks]**
- b. The factory manager informs you that they also like to produce canned peas. Describe the change you would make to the process. **[5 marks]**
- c. The factory manager would also like to process dried fruits for his personal business. State the types equipment used for drying and recommend one. Give reason for your recommendation? **[5marks]**

Question 2

- a. Explain the chocolate making process using a flow diagram. **[15 marks]**
 - b. A chocolate approaches you a problem of a white layer on the chocolate in their shop. Diagnosis the problem and offer possible solutions. **[5marks]**
 - c. Show the difference between black tea and green tea using flow diagrams only. **[5marks]**
-

END OF EXAMINATION

Good Luck!!!

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

**2011 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGF 542: PLANT DESIGN

TIME: THREE HOURS

INSTRUCTIONS:

1. Please read the instructions and each question carefully.
2. Answer **ALL** questions.
3. **ALL** questions carry equal marks.

1. You see an opportunity to put up a medium scale rice processing project in Kasama district. After doing a market research, you come up with the findings that indeed there is a market for this product both locally and in the immediate neighborhood of Congo DRC. You have identified a supplier in China who is willing to supply you a complete set of rice processing equipment. The equipment can handle 20 tones of feed per day and has the energy requirement of 155 kW. It is complete with: Screening and selecting machine, bucket elevator, specific gravity stone cleaner, rubber roller huller, specific gravity paddy separator, rice mill with blowing wind, rice sorter and rice packaging machine

The total cost of the equipment (freight inclusive up to Dar es Salaam) is 65, 000 USD. The cost of transporting the equipment from the port to Kasama has been given by TAZARA to be 5,000 USD. Current exchange rate is USD 1 = ZMK 4650.

The ground rules will be as follows:

- a) The plant will operate 15 hours day, 7 days /week, 50 weeks/year and 350 days year.
- b) Utilities in the form of electricity, water, and so on are available in the area.
- c) Projected sales forecast: 50 % of the product sold per annum and the price of rice will be set at ZMK 7500 per Kg.
- d) Take a rough recovery of product to be 48% of the feed

Other important information for the project

1. Assume ZESCO tariff to be K924/kWh
2. Operating labor, 5 people at K8,000,000 each gross per month
3. Raw material cost: K1,000,000 per tone
4. Miscellaneous materials: estimated at 10% of the maintenance cost
5. Maintenance cost: estimate at 5% of the fixed capital
6. Laboratory costs: Take as 30% of the operating labor
7. Capital charges (CEEC rate at about 7.5%) of the fixed capital
8. Insurance (estimate at 1% of the fixed capital)
9. Miscellaneous (Taxes, sale and promotion, Research and development): estimate at 5% of the fixed capital

Table 1: Typical factors for estimation of project fixed capital cost

Item	Process type		
	Fluid	Fluid-Solids	Solids
1. Major equipment, total purchase cost	PCE	PCE	PCE
f_1 Equipment erection	0.4	0.45	0.5
f_2 Piping	0.70	0.45	0.20
f_3 Instrumentation	0.20	0.15	0.10
f_4 Electrical	0.10	0.10	0.10
f_5 Building, process	0.15	0.10	0.05
f_6 Utilities	0.50	0.45	0.25
f_7 Storage	0.15	0.20	0.25
f_8 Site development	0.05	0.05	0.05
f_9 Ancillary buildings	0.15	0.20	0.30
2. Total physical Plant Cost (PPC) $PPC = PCE(1 + f_1 + \dots + f_9)$			
f_{10} Design and engineering	0.30	0.25	0.20
f_{11} Contractor fee	0.05	0.05	0.05
f_{12} Contingency	0.10	0.10	0.10
Fixed capital = $PPC (1 + f_{10} + f_{11} + f_{12})$			

- a) Estimate the total investment cost for the project using factored estimate approach based on the cost of the major equipment. **(10 points)**
- b) Is this investment worth making? Show by performing detailed calculations and your judgment should be based on the economic evaluation criteria of projects such Rate of Return (ROR) and the Pay-back period. **(15 points)**

2. In a storage place, two compartments are connected in series. The two compartments are labelled as compartment 1 and compartment 2 as shown in figure 2 below. Inside them two different agricultural products, i.e., product 1 and product 2 are stored in the respective compartments. In compartment 2 there is a humidifying equipment (W_2 in figure) that injects water at a rate of 0.002 kg/s . The outside temperature and absolute humidity is 5°C and 4 g/kgDA respectively. Part of the outside air is heated to 8°C and supplied to compartment 1 (V_2 in the figure) at the rate of $0.243 \text{ m}^3/\text{s}$. The k -value for all the walls roofs and floors is reported to be $1.5 \text{ W/m}^2\cdot^\circ\text{C}$. Table 1 shows product, environmental and material property data.

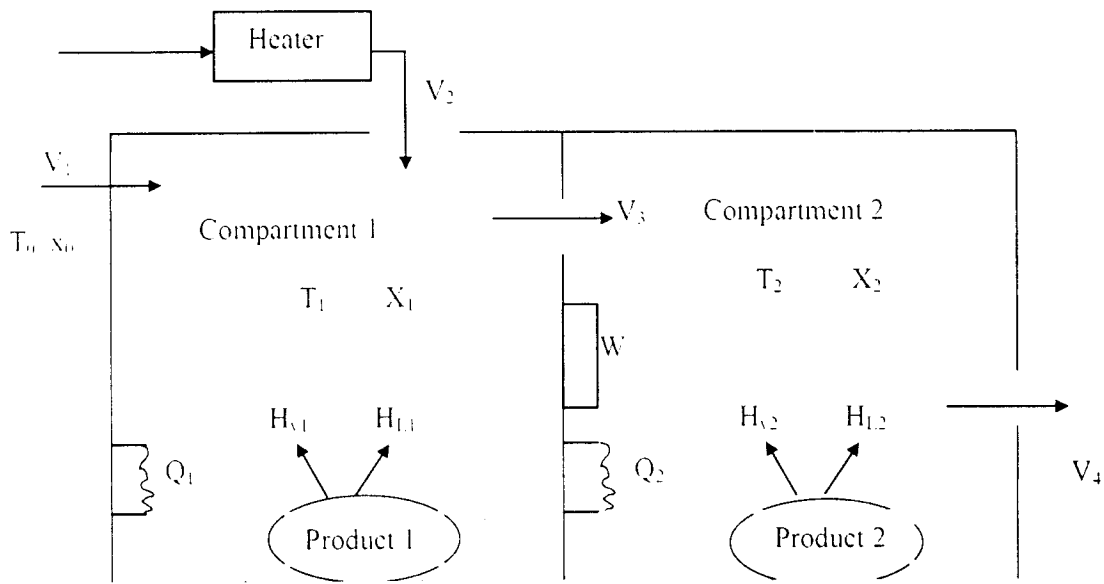


Table 1. Product, environmental and material properties

Compartment 1	Compartment 2
$L = W = H = 5\text{m}$	$L = W = H = 5\text{m}$
$H_{v1} = 500\text{W}$	$H_{v2} = 388\text{W}$
$H_{l1} = 550 \text{ W}$	$H_{l2} = 420\text{W}$
$T_{\text{opt}} = 10^\circ\text{C}$	$T_{\text{opt}} = 15^\circ\text{C}$
$X_{\text{opt}} = 6\text{g/kgDA}$	$X_{\text{opt}} = 8 \text{ g/kg DA}$
$\gamma = \text{Dry air density}$	1.2 kg DA/m^3
$C_p = \text{Specific heat of dry air}$	$1.005 \text{ kJ/kgDA}\cdot^\circ\text{C}$
$\varepsilon = \text{Heat of Vaporisation of water}$	$2501 \text{ KJ. (Kg H}_2\text{O)}^{-1}$

Assuming optimum conditions are fulfilled for the two products,

- a) Is there a need to install humidifier or dehumidifier inside compartment 1? Justify your answer. **(11 points)**
 - b) Calculate Q_1 and Q_2 . **(10 points)**
 - c) Outline four ways by which the process of air conditioning can be achieved to bring about the desired temperature and humidity levels **(4 points)**
3. An investor would like to purchase an evaporator for his newly built plant to be used for concentrating pure orange juice. You have been approached as a plant design engineer to give him technical advice.
- a) Outline to him **six** important factors to be considered when selecting the above mentioned equipment. **(10 points)**
 - b) What would be your advice on aluminum, cast iron and stainless steel as materials of construction **(9 points)**
 - c) Mention at least any **four** specification that he may look for from the vendors of this equipment **(4 points)**
 - d) List at least **two** techniques/procedures for making cost estimates of individual items **(2 points)**
4. You have formed a joint venture and intend to put up a mango processing project in Mongu district of Zambia that will be processing a variety of mango based products to cater for both the local and regional markets.
- a) Right now you are in Mongu, please discuss with me five factors that may influence your site selection decision. **(7.5 points)**
 - b) With regard to plant layout, describe briefly five principal factors that will ensure economic construction and efficient operation of the process units **(7.5 points)**
 - c) Discuss the social forces that you may consider important during your planning stage before venturing into this business **(7.5 points)**
 - d) Do a brief competitor analysis for this business of mango processing you have decided to venture into. **(5 points)**

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 (12 marks)

- a) More energy is required to extract water from soil particles in a soil with a matric potential of -7 bars than to extract pure water from a solution made by dissolving 150 grams of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in 2 litres of pure water at 25° C.
- b) Twenty (20) kilograms of Urea (46% N) contains more nitrogen than 50 kg of $(\text{NH}_4)_2\text{HPO}_4$.
- c) The decomposition of a sea weed with a composition $\text{C}_{106} \text{H}_{263} \text{O}_{110} \text{N}_{16} \text{P}$ in the soil will result in the mineralization of phosphorus and nitrogen.
- d) Saline sodic soils have more stable aggregates than non saline sodic soils.
- e) Aluminium toxicity is more likely to occur in acid mineral soils than in acid organic soils.
- f) Water in soil always moves from a region of high water content to a region of low water content.
- g) A mixture of 80 % pure calcite (CaCO_3) and 20 % quartz has a higher acid neutralizing value than pure siderite (FeCO_3)
- h) The Isomorphous substitution can take place between Ca^{2+} and Zr^{4+} .

Useful Atomic masses: Ca= 40g Na =23g, Mg =24g, C=12g, O=16g, S=32 g P=31g, H=1g,
Fe=56 g N=14g

2. Define the following terms (15 marks)

- a) Compound Fertilizer
- b) Photoautotrophic microorganism
- c) Isomorphous substitution
- d) Immobilization of nutrients
- e) Permanent Wilting Point
- f) Active Acidity

3. Answer the following questions briefly and concisely (25 marks)

- The macronutrients, nitrogen, phosphorus and potassium undergo fixation in soils. Define nitrogen, phosphorus and potassium fixation and describe how they occur in soil. (7.5 marks)
- $\text{CO}(\text{NH}_2)_2$, $(\text{NH}_4)_2\text{HPO}_4$ and KCl are three chemical compounds commonly used as fertilizers. Answer the following: (i) Indicate the Trade names of these materials as fertilizers, and whether they are straight or compound fertilizers. Give reasons to support your answers. (ii) Give the guarantees of these chemical compounds in terms of % N: % P_2O_5 : % K_2O . Show calculations to support your answers. (7.5 marks)
- Describe how fungi and bacteria contribute to making nitrogen and phosphorus available to plants in soil. (5 marks)
- List the components of the total water potential in an unsaturated soil and describe how each of them affects the total water potential. (5 marks)

Useful Atomic masses: C = 12g, N=14 g, P=31 g; Cl=35.5 g; O= 16 g; H=1 g; K= 39 g

- 4 Tensiometers are instruments used to measure the matric potential of soils. Below are Tensiometer readings expressed as suctions in cm that were obtained at three different depths of a soil used to cultivate tomato.

<u>Horizon</u>	<u>soil depth (cm)</u>	<u>Suction (cm)</u>
A	15	660
B1	30	540
B2	60	500

Based on the data provided above answer the following questions: (18 marks)

- Is the soil in the tomato field saturated with water or not? Give reasons to support your answer?(2.5 marks)
- If the osmotic potential of the water in this soil is equivalent to that of a 0.01 molal solution of $\text{Na}_2\text{MgSO}_4 \cdot 4\text{H}_2\text{O}$ at 20 °C, calculate the total soil water potential in bars at each of the three soil depths. Use the soil surface as the reference level for your calculations. (8 marks)
- With the help of a diagram showing the three points in the A, B1 and B2 horizons, indicate the direction of water flow among the points? Give reasons to support your answer. (5 marks)
- If the A horizon has a field capacity of 18 $\text{cm}^3\text{H}_2\text{O}/100 \text{ cm}^3$ soil, is the volumetric moisture content of the A horizon greater or less than 18 %? Give reasons to support your answer. (2.5 marks)

Useful data: $R = 8.3415 \text{ Jmole}^{-1} \cdot \text{K}^{-1}$. 0 °C =273.15 K

5 A soil from Kawambwa has the following selected physical and chemical properties.

Depth (cm)	pH (CaCl ₂)	pb g.cm ⁻³	Available P mg/ kg soil	K	Al ³⁺	H ⁺	ECEC	CEC _{8.2}	Org C	Total N	Clay
0 -20	4.8	1.44	3.4	0.1	0.8	0.3	3.4	6.6	1.5.	0.081	17

Answer the following questions based on the soil with the above properties. (30 marks)

- i) Calculate the base saturation of this soil based on the ECEC. (2.0 marks)
- ii) What is the agronomic classification and interpretation of the pH of this soil? (2.0 marks)
- iii) How long will it take for the organic matter content of this soil to drop to 2.5 % if the soil has a constant respiration rate of 4.5 mg C/kg soil per day? (4 marks)
- iv) Given that the negative charge on soil organic matter is variable charge, calculate the percentage of the CEC of this soil measured at pH 8.2 that is due to variable charge? (3.0 marks)
- v) If the soil has a constant respiration rate of 10 mg C/kg soil in the rainy season and the microbes assimilate 75 % of nitrogen released during the decomposition of organic matter, how much nitrogen will be mineralized per hectare of this soil in 3 months during the rainy season? (4 marks)
- vi) Based on the amount of N mineralized in 3 months, and the available levels of K and P in the soil, determine if this soil would meet the requirements of a crop that needs 130 kg Nitrogen /ha, 30 kg P/ha and 110 kg K/ha over a 3 months growing period. Give reasons to support your answer (6 marks)
- vii) How many 50 kilograms bags of Compound D (10:20:10) Urea (46:0:0) and Muriate of potash (0:0:60) would be required to meet shortfalls in available N,P and K on a 4 hectare plot for the crop described above? (5 marks)
- viii) How much Agricultural lime is required per hectare to neutralize 50 % of the total acidity of the soil based on the CEC measured at pH 8.2, if the Agricultural lime available has a Neutralizing Value of 78 %? (4 marks)

SOIL SCIENCE IS FUN

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
2010 SECOND SEMESTER EXAMINATIONS
AGS 331

SOIL SURVEY TECHNIQUES

INSTRUCTIONS: ANSWER ALL QUESTIONS

TIME: THREE (3) HOURS

MARKS: 65

1. a) How useful would soil survey information be in fisheries? (4 marks)
b) Explain the different approaches in soil surveying. (6 marks)
2. A soil is classified as an Ustox at suborder level. Answer the following questions:
 - a) Describe the general characteristics of the soil. (5marks)
 - b) Explain its main agricultural limitations. (5 marks)
3. a) What is a soil catena? (5 marks)
b) What is soil variability? (5 marks)
4. a) Explain the main characteristics of the Zambian Land Capability Classification System. (5 marks)
b) Explain the meaning of each of the following land capability classes: (10 marks)
 - i. C3w
 - ii. S1d
 - iii. Gw
 - iv. C4d
 - v. S2s
5. a) How are air-photos used in soil survey? (5 marks)
b) Explain what is involved in the field stage of a soil survey. (5 marks)
6. Explain the different levels of soil survey as used in Zambia (10 marks)

END OF EXAMINATION

UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS-MAY, 2011

AGS 322
SOIL PHYSICS

Time: Three (3) Hours

Marks: 85

Instruction: Answer all Questions

Non-programmable calculators are allowed

1. Briefly define each of the following terms **(15 marks)**
 - a) Void ratio
 - b) Hydraulic conductivity
 - c) Soil water capacity
 - d) Available water capacity
 - e) Laplace equation
2. With the aid of a diagram briefly describe factors that lead to hysteresis of the retention and loss of water by the soil **(15 marks)**
3. The application of the general flow equation depends on a number of factors: **(15 marks)**
 - a) Describe briefly the main factors that affect its application,
 - b) Develop equations for vertical flow
4. A layered vertical soil column consists of a loamy textured soil ($L=75\text{cm}$) with a sandy textured soil ($L=25\text{cm}$) layer over it. The top of the column has water ponded at a constant height of 20 cm above it, and the bottom is open to the atmosphere. The hydraulic conductivity of the sandy layer is five times greater than the loamy layer. If the discharge is $-13.75 \text{ cm}^3/\text{hr}$ over a cross-sectional area of 100cm^2 : **(20 marks)**

- a) Calculate the flux in (i) mm/day and (ii) $\text{m}^3/\text{day}/\text{ha}$
 - b) Calculate the water potential (h) at the interface between the two layers (in cm)
 - c) Calculate (i) the hydraulic conductivities of each layer and (ii) the effective hydraulic conductivity of the entire system (in mm/day)
 - d) If another layer ($L=10\text{cm}$) was added in between the two layers and the flux remained the same, calculate its hydraulic conductivity (in mm/day)
5. Given the following soil moisture and matric head measurements obtained using a neutron probe and tensiometers in an irrigated maize field at the University Farm, **(20 marks)**

	June 10		June 17	
Depth (cm)	h (cm)	θ_v (%)	h (cm)	θ_v (%)
10	-278.2	16.8	-448.2	7.5
30	-172.5	18.6	-245.5	15.9
50	-136.1	17.3	-155.0	16.2
70	-117.4	16.8	-132.5	16.7
90	-101.2	24.1	-116.2	24.2
110	-131.6	15.2	-132.8	15.5

From the above data:

- a) Determine the average depth for the plane of zero flux
- b) Determine the change in soil water storage from the surface to the plane of zero flux (in m^3/ha)
- c) Determine the amount of water loss (mm) in the profile through (i) the soil surface and (ii) depth below 110 cm
- d) Determine the hydraulic conductivity at the depth of 90 cm

End of Exam

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS
MAY 2011
AGS 422: SOIL MICROBIOLOGY

TIME: 3 HOURS

MARKS: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS

1. Environmental bioremediation and waste management is an area that can potentially benefit from the application of microbiology. Explain:
 - a. Three possible reactions involving microbes that might be useful in this process [9 marks]
 - b. The reasons why composting as a waste management option, on a large scale, might fail [6 marks]
 - c. The two different ways in which fungi can be used in bioremediation and waste management [5 marks]
2. The establishment of the relationship between rhizobia and legumes is accomplished through a series of stages, all of which are mediated by a chronological cascade of physiological signals from both participants.
 - a. Outline the stages of symbiotic N fixation establishment [15 marks]
 - b. Explain why nodules actively metabolizing nitrogen are pink/red in colour [5 marks]
 - c. Giving examples of agronomic crops in which these would be found, discuss the differences between determinate and indeterminate nodules [10 marks]
3. *Rhizobia* spp are gram negative, non-spore forming and mostly motile bacteria that can grow readily in culture. Explain how you would:
 - a. Go about isolating the *Rhizobia* spp. from the soil [5marks]
 - b. Ensure the successful culture of the bacteria after isolation. [5 marks]

4. Nitrogen in soil undergoes many different transformations most of which are mediated by microbes. List the terminal forms of N and their oxidative states resulting from the following N transformation processes:
- Mineralization [2.5 marks]
 - Immobilization [2.5 marks]
 - Nitrification [2.5 marks]
 - Denitrification [2.5 marks]
5. 'It is difficult to determine the exact population of microorganisms in the soil or know if they are living and active.' Describe two methods in microbiology, based on properties of living organisms, that could be used to respond to the above statement positively. [10 marks]
6. (i) In Zambia, conservation farming involves five principal practices two of which are:
- Retention of crop residues in fields, with no burning
 - Rotations with nitrogen-fixing legumes with a minimum of 30% legumes in the system.
- Discuss how soil microorganisms play a role in the accomplishment of the objectives of conservation farming in view of the two principles listed above [15 marks]
- (ii) A laboratory analysis of *Tithonia diversifolia* has shown that it contains 0.15-0.2% P on a dry weight basis. This level of P is higher than that found in legumes commonly used in agroforestry. Explain why this is the case. [5 marks]

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS
MAY 2011

AGS 452 PRINCIPLES OF LAND HUSBANDRY

TIME: 3 HOURS

MARKS: 85

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. Define the following:
 - a. Soil fertility [2 Marks]
 - b. Soil productivity [2 Marks]
 - c. Land degradation [2 Marks]
 - d. Soil erosion [2 Marks]
 - e. Waterlogging [2 Marks]
2. There are different factors which contribute to low adoption of new land management technologies in a particular area. Briefly discuss five (5) of these factors stating:
 - a. How they affect adoption of technologies, and [7.5 Marks]
 - b. How the difficulties related to these factors can be overcome. [7.5 Marks]
3. For different forms of constraints you need to use different alleviation strategies. Explain and give two (2) examples of:
 - a. Alleviation of constraints by changing characteristics of use [6 Marks]
 - b. Alleviation of constraints by changing severity. [6 Marks]
4. Recommendation domain is an important concept for extension workers.
 - a. Give the meaning of recommendation domain citing examples [6 Marks]
 - b. Discuss the type of information you would consider and why it would be necessary to consider such information in the process of coming up with a recommendation domain. [10 Marks]
5. There are two concepts which are important when defining characteristics of land user groups. Discuss the implications of each of the two concepts below:
 - a. The concept of "optimal ignorance" [5 Marks]
 - b. The concept of "appropriate imprecision". [5 Marks]
6. Farmers are the ultimate decision-makers on what happens on their land. Briefly discuss the different factors that affect the decisions they make. [10 Marks]
7. What are the main characteristics which distinguish the different types of farming (resource-poor, small scale, commercial, etc.) and why do you think these characteristics are important? [10 Marks]
8. What role does placement of watering points have on level of land degradation? [2 Marks]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS – MAY 2011

AGS 522
SOIL AND PLANT ANALYSIS

TIME: 3 HOURS

Marks: 90

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

1. Describe briefly the nature of injury caused to crops by the following:
 - a. Herbicide [2 Marks]
 - b. Air pollution [2 Marks]
 - c. Insect pests [2 Marks]
 - d. Nematode attack [2 Marks]
 - e. Soil compaction [2 Marks]
2. The quality of Soil and Plant analysis laboratory results depend to a large extent on the sampling quality.
 - a. Briefly state two (2) important points to be considered when taking soil samples. [4 Marks]
 - b. Briefly describe how you would take a good diagnostic plant sample stating the most important issues to bear in mind. [6 Marks]
 - c. Why is it advisable to avoid sampling vegetative organs after flowering in non-woody determinate species? [2 Marks]
 - d. In some cases soil samples may be taken from as much of crop rooting profile as possible. Give three (3) reasons for deeper soil sampling. [6 Marks]
3. Measurements and calculations are important aspects of laboratory procedures.
 - a. What is the mass of NaCl required to make 750 mls of a 0.01 M solution given that the atomic mass for Na is 23 and that of Cl is 35.5 [4 Marks]
 - b. What volume (ml) of concentrated H₂SO₄ is required to prepare 500 ml of 2 M Sulphuric acid? Sulphuric acid is 96% concentrated, molecular weight is 98 and specific gravity is 1.84. [4 Marks]
 - c. Convert 500 µg Mg g⁻¹ soil to meq Mg 100 g⁻¹ soil. [4 Marks]

4. In Soil Analysis different methods are used to determine different parameters.
- a. Describe the different steps involved in the determination of Total N in the soil using the Kjeldhal method. [8 Marks]
 - b. List six (6) physical factors which affect the extraction of available phosphorus. [12 Marks]
 - c. Explain how to extract and determine the concentrations in the soil of the four elements generally referred to as bases. [8 Marks]
 - d. Describe four (4) methods used to determine lime requirement. [8 Marks]
5. Sulphur is an important essential element.
- a. Give two (2) main reasons why S is generally not determined on routine basis. [4 Marks]
 - b. Describe and explain the principle behind any two (2) methods used to determine concentrations of S in soil extracts. [10 Marks]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS – MAY 2011

AGS 522
SOIL AND PLANT ANALYSIS

TIME: 3 HOURS

Marks: 90

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

1. Describe briefly the nature of injury caused to crops by the following:
 - a. Herbicide [2 Marks]
 - b. Air pollution [2 Marks]
 - c. Insect pests [2 Marks]
 - d. Nematode attack [2 Marks]
 - e. Soil compaction [2 Marks]
2. The quality of Soil and Plant analysis laboratory results depend to a large extent on the sampling quality.
 - a. Briefly state two (2) important points to be considered when taking soil samples. [4 Marks]
 - b. Briefly describe how you would take a good diagnostic plant sample stating the most important issues to bear in mind. [6 Marks]
 - c. Why is it advisable to avoid sampling vegetative organs after flowering in non-woody determinate species? [2 Marks]
 - d. In some cases soil samples may be taken from as much of crop rooting profile as possible. Give three (3) reasons for deeper soil sampling. [6 Marks]
3. Measurements and calculations are important aspects of laboratory procedures.
 - a. What is the mass of NaCl required to make 750 mls of a 0.01 M solution given that the atomic mass for Na is 23 and that of Cl is 35.5 [4 Marks]
 - b. What volume (ml) of concentrated H_2SO_4 is required to prepare 500 ml of 2 M Sulphuric acid? Sulphuric acid is 96% concentrated, molecular weight is 98 and specific gravity is 1.84. [4 Marks]
 - c. Convert $500 \mu\text{g Mg g}^{-1}$ soil to $\text{meq Mg } 100 \text{ g}^{-1}$ soil. [4 Marks]

4. In Soil Analysis different methods are used to determine different parameters.
- a. Describe the different steps involved in the determination of Total N in the soil using the Kjeldhal method. [8 Marks]
 - b. List six (6) physical factors which affect the extraction of available phosphorus. [12 Marks]
 - c. Explain how to extract and determine the concentrations in the soil of the four elements generally referred to as bases. [8 Marks]
 - d. Describe four (4) methods used to determine lime requirement. [8 Marks]
5. Sulphur is an important essential element.
- a. Give two (2) main reasons why S is generally not determined on routine basis. [4 Marks]
 - b. Describe and explain the principle behind any two (2) methods used to determine concentrations of S in soil extracts. [10 Marks]

END OF EXAMINATION

UNIVERSITY OF ZAMBIA, SECOND SEMESTER EXAMINATIONS

AGS 542

SOIL GENESIS AND CLASSIFICATION

MAY, 2011

Marks: 100

Instructions: Answer all questions:

Time: 3 hours

1. Define the following terms: (12 marks)

- a. Bh horizon
- b. Aquic moisture regime
- c. Argillans
- d. Siliceous mineralogy
- e. Rubification
- f. Natrustalf

2. Indicate whether the following statements are true or false or whether you don't know the correct answer (18 marks). (2 for correct answer, 0 for I don't know, and -1 for wrong answer)

- a. A surface horizon with a C: N ratio of 16.03: 1 that contains 0.053 % nitrogen, meets the organic carbon requirement for a Mollic epipedon.
- b. Gleization is more likely to occur in a soil with an Aquic moisture regime than in a soil with a Udic moisture regime.
- c. A soil derived from quartzite is likely to contain less clay than a soil derived from granite.
- d. A field with a Cryalf will be more suitable for growing sugarcane under irrigation than a field with an Ustalf.
- e. A horizon containing 37 % clay, with a sum of exchangeable bases of 9.9 meq/100 g, and a base saturation of 66 % based on the CEC with NH_4OAc at pH 7 has high activity clay.
- f. A montmorillonitic mineralogy is likely to be associated with a Chromustert than with a Haplustox
- g. A natric horizon can have a base saturation of 10 % based on the CEC with NH_4OAc .
- h. A surface horizon containing 10 % organic carbon and 32 % clay in the mineral fraction meets the organic carbon requirement for a Histic epipedon.
- i. A predominance of Acacia vegetation in Zambia is often soils derived from limestone.

3. Soil Taxonomy is one of the most widely used International Soil Classification Systems. Answer the following questions related to this classification system: **(15 marks)**
- List the different categories of classifying soils in Soil Taxonomy. (4 marks)
 - List the 12 Orders of Soil Taxonomy and indicate which of these occur in Zambia. (4 marks)
 - What criteria are used to classify soils at family level in Soil Taxonomy? (3 marks)
 - Which Orders of Soil Taxonomy are classified on the basis of possession of certain diagnostic surface or subsurface horizons? Indicate the diagnostic horizon or horizons associated with each of the soil orders you have listed. (5 marks)
4. Chemical weathering is one of the main processes responsible for the formation and development of soils. Please answer the following: **(25 marks).**
- Write a balanced reaction of the weathering of biotite $[K(Fe_2Mg)(Si_3Al)O_{10}(OH)_2]$ in the presence of oxygen and carbonic acid to form Gibbsite $Al(OH)_3$ and Hematite (Fe_2O_3) . (6 marks)
 - What subsurface diagnostic horizon is likely to form as a result of the weathering reaction described in 4a under conditions of high rainfall and good drainage in a tropical region? Give reasons to support your answer. (4 marks)
 - Would the horizon that develops under conditions described above have high or low activity clay? Give reasons to support your answer. (3 marks)
 - To which order in Soil Taxonomy would the soil that forms under conditions described above belong? Give reasons to support the answer. (4 marks)
 - What is likely to be the soil reaction, general fertility status and availability of P in the soil horizon that would form under conditions described in 4c? Give reasons to support your answer. (4 marks)
 - If the subsurface horizon is 35 cm thick and is 55 cm below the soil surface calculate the thickness of the horizon that will be part of the control section of the moisture regime of the soil given that the overlying horizon has a water holding capacity of $8 \text{ cm}^3/100 \text{ cm}^3$, while the subsurface horizon has a water holding capacity of $7 \text{ gH}_2\text{O}/100 \text{ g soil}$ and a bulk density of 1370 kg/m^3 . (4 marks)

5. A Bt horizon from a soil profile in Zambia was sampled and analyzed to determine the composition of the soil solution. The results of the analyses are presented below:

Depth	pH	CO ₃ ²⁻	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	SO ₄ ²⁻	Cl ⁻
(cm)	H ₂ O	mg/L						
60-90	9.45	363	46	44	12	2784	8765	496

Answer the following questions: (30 marks)

- Calculate the Sodium Adsorption Ratio of this horizon? (4 marks)
- What is the name of this Bt horizon in Soil Taxonomy? Give reasons to support your answer? (3 marks)
- Given that the sum of cations in solution (meq/L) \approx EC (mS/cm) x10, and that the Osmotic potential (bars) \approx EC (mS/cm)x(-0.36), estimate the EC (in mS/cm) and Osmotic potential (in bars) of the soil solution and classify this horizon in terms of its salinity and sodicity. (7 marks)
- Determine if gypsum and calcite are likely to form in this horizon at 25°C and 1 bar pressure assuming the values given in the table represent the activities of ions? Use the thermodynamic data for gypsum and calcite given below in the calculations to support your answer. (8 marks)
- In which Agro-Ecological Zone of Zambia would one expect to find this soil? Give reasons to support your answer (4 marks).
- If the above soil has an ochric epipedon, to which order of Soil Taxonomy will it belong? Give reasons to support your answer? (4 marks)

Thermodynamic data of species that may be relevant for answering 5 are given below:

Species	ΔG_f° (KJ/mol)
CaCO ₃	-1129.07
CaSO ₄ .2H ₂ O	-1797.36
Ca ²⁺	-552.8
SO ₄ ²⁻	-744.0
CO ₃ ²⁻	-527.9
H ₂ O	-237.14

Useful Atomic Masses: Ca= 40; S=32; C=12; O= 16; Na= 23; Mg= 24; H=1; K= 39

END OF EXAMINATION

UNIVERSITY OF ZAMBIA

SECOND SEMESTER EXAMINATIONS – MAY 2011

AGS 562: Management of Irrigation and Drainage systems

Time: 3hrs

Marks: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS. WRITE CONCISELY AND LEGIBLY. WRITE ALL NON-NUMERICAL QUESTIONS IN ESSAY FORMAT (NOT BULLET POINTS)

Q1. Describe the following terms giving the advantages and disadvantages of each:

- i. Solid set system
- ii. Periodic move systems
- iii. Centre pivot
- iv. Travelers

(20 marks)

Q2. Mr. Chimusoro is a practicing commercial farmer; mention the benefits he would get from having a good drainage system incorporated in his farming system

(10 marks)

Q3. Write briefly on each of the following:

- i. Decision criteria in irrigation projects
- ii. Irrigation uniformity
- iii. Irrigation efficiency
- iv. Pumping head requirement
- v. Irrigation Set time

(10 marks)

Q4. In sprinkler irrigation systems, what factors affect uniformity of water distribution and how can these factors be remediated? (15 marks)

Q5. Determine the system capacity for a sprinkler irrigation system to irrigate 16 hectares of Maize crop. Design moisture use rate is 5 mm per day. Moisture replaced in soil at each irrigation event is 6 cm. Irrigation efficiency is 70 percent. Irrigation period is 10 days in a 12 day interval. The system is to be operated for 20 hours per day.

(15 marks)

Q6. Mr. Jere, a retiree has a 16 ha piece of land which he would like to put under irrigation. He consults you as an expert to help him with the layout of a sprinkler irrigation system layout. After some measurements you determine that, the land has loamy soils with a terminal infiltration rate equal to 1.1 mm hr^{-1} , and depth equal to 0.5 m. Mr. Jere prefers a groundnut crop with maximum root growth equal to 30 cm with an average k_c of 0.87. The prevailing ETo in the area is 6 mm /day. The dimensions of the field are 800 m x 200 m. Due to water scarcity problems Mr Jere does not want to compromise on the system application efficiency maintaining that it has to be at least 75 %. He has enough resources to purchase 4 laterals to be operated during each shift. The layout imposed by the market availability of components is 12 m x 18 m. Mr. Jere being a family man, can only afford to dedicate 12 hours each day to the operation of the irrigation system and needs a day for other farm operations. Design a suitable sprinkler irrigation system for Mr. Jere with the main line positioned on one edge of the field. For the designed system developed, specify the:

- i. Net water application depth
- ii. Gross water application depth
- iii. Sprinkler precipitation rate
- iv. Irrigation frequency and Irrigation cycle
- v. Required system Capacity
- vi. Sprinkler discharge rate

(30 marks)

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