THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/14 EXAMINATIONS

1. AGA 2110 Anatomy and physiology of domestic animals
2. AGA 3210 Principles of animal nutrition
3. AGA 3212
4. AGA 4311 Principles of genetics
5. AGA 4511 Beef and small ruminant production
6. AGA 4522 Dairy and rabbit production
7. AGA 4531 Introduction to aquaculture
8. AGA 4532 Pig and poultry production
9. AGA 4542 Game ranching
10. AGA 4552/552 Animal production and by products
11. AGA 511 Techniques in animal science
12. AGA 521 Applied animal production
13. AGA 5712 Animal health
14. AGC 2010 Fundamentals of crop production
15. AGC 3342 Crop protection
16. AGC 3412 Introductory horticulture
17. AGC 4320 Principles and application of entomology
18. AGC 511 Aspects of crop production
19. AGC 521 Plant breeding ii
20. AGC 542 Advanced horticulture
21. AGC 562 Seed technology
22. AGC 572 Post harvest technology
23. AGE 2111 Fundamentals of micro- economics
24. AGE 2122 Fundamentals of macro-economics
25. AGE 3381 Research methodology
26. AGE 4142 Agricultural marketing
27. AGE 4211 Introduction to agribusiness management

28.AGE 4222 Intermediate agribusiness management
29.AGE 4311 Quantitative methods in agricultural economics
30.AGE 4322 Applied economics
31.AGE 511 Agricultural organization and administration
32.AGE 531 International agricultural markets, trade and development
33.AGE 541 Agricultural project planning and appraisal
34.AGE 562/5262 Intermediate farm management
35.AGE 572 Agricultural policy analysis
36.AGE 582 Project monitoring and evaluation
37.AGE 5241 Principles of farm management
38.AGF 2015 Fundamentals of organic chemistry
39.AGF 2401 Introduction to information technology and communication
40.AGF 3021 Chemical techniques in food analysis
41.AGF 3031 Food chemistry
42.AGF 3042 Instrumental methods in food analysis
43.AGF 3100 General and food microbiology
44.AGF 3412 Food toxicology
45.AGF 4052 Sensory evaluation of foods
46.AGF 4065 Nutrition
47.AGF 4210 Unity operation in food engineering
48.AGF 4221 Process control and instrumentation
49.AGF 4232 Fundamentals of biochemical engineering
50.AGF 4300 Food processing and packaging
51.AGF 4422 Water and food waste management
52.AGF 511 Unity operations in food engineering ii
53.AGF 512 Technology of meat and fish products
54.AGF 521 Principles of food technology
55.AGF 522 Technology of fermented products
56.AGF 531 Technology plant products and beverages
57.AGF 541 Technology of dairy and egg production
58.AGF 542 Plant design
59.AGF 5432 Food safety and quality management
60.AGG 3811 Rural sociology
61.AGG 3822 Agricultural extension
62.AGG 3822 Forage crop production and range

63.AGG 4851 Experimental design and statistical analysis
64.AGN 2110 Anatomy and physiology
65.AGN 2212 Principles of human nutrition
66.AGN 3222 Human nutrition
67.AGN 3232 Principles of dietetics
68.AGN 3311 Nutrition assessment
69.AGN 3510 Nutrition communication and health promotion
70.AGN 4122 Drug interactions
71.AGN 4241 Nutrition disorders
72.AGN 4321 Research methods for epidemiology for nutritionists
73.AGN 4410 Diet formulation and dietetic management
74.AGN 4520 Public health and nutrition
75.AGS 2011 Fundamentals of soil science
76.AGS 2110 Fundamentals of soil science
77.AGS 3312 Soil physics
78.AGS 4210 Soil mineralogy and chemistry
79.AGS 4221 Soil and plant analysis
80.AGS 4232 Soil fertility and amendments
81.AGS 511 Soil chemistry
82.AGS 522 Soil and plant analysis
83.AGS 531 Land evaluation and improvements
84.AGS 551 Irrigation systems
85.AGS 562 Irrigation management and scheduling
86.AGS 5612 Land evaluation and improvement

THE UNIVERSITY OF ZAMBIA

FACULTY OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

FINAL EXAMINATION QUESTIONS - 2013/14

COURSE: AGA 2110 ANATOMY AND PHYSIOLOGY OF DOMESTIC ANIMALS
DURATION: THREE (3) HOURS

INSTRUCTIONS: CAREFULLY READ INSTRUCTIONS FOR EACH SECTION
ANSWER EACH SECTION IN A SEPARATE ANSWER BOOK
WRITE THE NUMBER OF EACH ATTEMPTED QUESTION

SECTION A

INSTRUCTIONS: ANSWER QUESTION ONE AND EITHER QUESTION TWO OR QUESTION THREE IN THIS SECTION

QUESTION ONE

A. Briefly describe the following terms as used in anatomy and physiology of domestic animals; **[10]**

i. Pampiniform plexus
ii. Foramen ovale
iii. Arrector pili muscle
iv. Gland cistern
v. Spermatogenesis

B. In order to perform their normal function, cells acquire oxygen from the external environment and this is carried to all parts of the body by the circulatory system.

i. Briefly describe the role played by two (2) principle components of the circulatory system. **[4]**
ii. Use a diagram to show the path taken by a blood cell in traversing through the heart. **[4]**
iii. It is said "veins carry deoxygenated blood while arteries carry oxygenated blood." State one reason why this may not necessarily always be true. **[1]**
iv. In relation to the circulatory system, what is lymph? **[1]**

QUESTION TWO

With regard to reproduction in domestic animals,

i. Draw and label the main features of a bicornuate reproductive system. **[6]**
ii. Name the gonadal cells involved in hormone synthesis in animals. **[4]**
iii. What are the stages of the oestrous cycle in cattle? **[4]**
iv. Name four organs commonly called accessory glands in male animals. **[4]**
v. State two anatomical differences between the reproductive system in poultry and that found in other domestic animals. **[2]**

QUESTION THREE

With regard to the integumentary system of domestic animals,

i. Use a labelled diagram to show the main features of this system. **[10]**
ii. Briefly describe two functions of the integumentary system? **[2]**
iii. Identify the forms of heat loss or gain indicated by the subscripts E, R, C, & G in the equation $M - E_E \pm E_R \pm E_C \pm E_G \pm S = 0$ **[4]**
iv. Discuss two effects of hyperthermia on animal production. **[2]**
v. What is the role of keratinocytes and melanocytes in animals? **[2]**

SECTION B

CHOOSE ANY TWO QUESTIONS FROM THIS SECTION AND WRITE THE ANSWERS IN A SEPARATE ANSWER BOOK.

QUESTION ONE

The cell membrane serves to separate and protect a cell from its surrounding environment and is made mostly from a phospholipid bilayer. Explain phospholipid bilayer concept on the basis of hydrophobic and hydrophilic properties. **[10]**

QUESTION TWO

Explain how skeletal muscle fibres differ from "typical" cells. With the aid of examples, state the muscle types and their structural characteristics. **[10]**

QUESTION THREE

Write short notes on the following; **[10]**

i. Endoskeleton
ii. Classification of the skeletal bones
iii. Functions of the bone

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
ANIMAL SCIENCE DEPARTMENT

2013/2014 ACADEMIC YEAR FIRST HALF FINAL EXAMINATIONS

COURSE AGA 3201: PRINCIPLES OF ANIMAL NUTRITION

DATE OF EXAMINATION: 4TH MARCH, 2014

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

i. **Answer Six (6) questions: ~~three~~ four (4) questions from Section A and any two (2) questions from Section B.**
ii. **Write the answers for Sections A and B in separate answer books.**

SECTION A NON-RUMINANT DIGESTION AND METABOLISM

Q1 Complete the table below:

Nutrient Digestion in the stomach of a non-ruminant (15 marks)

Nutrients	Digestive enzyme(s)	Source of enzyme (s) i.e. where are the enzymes produced or secreted from	Substrate for the named enzyme (specify substrates for specific enzymes)	Products of Digestion for each enzyme
Carbohydrates				
Lipids				
Protein				

Q2.

a. Give three important products of the Pentose Phosphate Pathway in metabolism **(3 marks)**

b. Adenosine Triphosphate (ATP) is the 'energy currency' of the cell. Compare ATP production in the process of glycolysis under aerobic and anaerobic metabolic conditions in the animal body **(12 marks)**.

Q3. (15 marks)

a. With the aid of flow charts/sketches outline β-oxidation of fatty acids in the animal body.

b. List the coenzymes involved in the process of β-oxidation of fatty acids.

c. Name the respective vitamins from which the coenzymes are produced

d. Give one deficiency sign you would expect to see if the precursor vitamin was deficient or lacking in the diet of a pig or chicken.

Q4. (15 marks)

a. Explain what is meant by 'glucogenic amino acid' and 'ketogenic amino acid'

b. For any five (5) amino acids :

i. List one biologically important nitrogen-containing compound for which the respective amino acids are precursors.

ii. Indicate whether the amino acids are glucogenic or ketogenic or both glucogenic and ketogenic.

SECTION B RUMINANT DIGESTION AND METABOLISM

Q1

a. Describe the four metabolic disorders that may be associated with improper fermentation of feedstuffs in the rumen. **(8 marks)**

b. How is each of these disorders brought about and how can they be minimized or prevented? **(12 marks)**

Q2

a. Explain in detail how the various products of rumen fermentation are mobilized to be utilized by the host animal? **(12 marks)**

b. How can you manipulate the rumen fermentation process in order to improve efficiency of nutrient utilization in ruminants? **(8 marks)**

Q3

a. Describe the main types of endogenous anti-nutrtional factors found in feedstuffs meant for feeding non-ruminants. **(8 marks)**

b. How can each of these antinutritional factors be minimized to improve feed utilization? **(6 marks)**

c. Explain the importance of feed processing when preparing diets for non-ruminants? **(6 marks)**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIERNCES

DEPARTMENT OF ANIMAL SCIENCE

AGA 3212 FINAL EXAMINATION

INSTRUCTIONS

Answer **any five** questions from the six provided

All question carry equal marks (20 Marks)

QUESTION ONE

Using a Pearson Square formulate a broiler starter ration to have 1.20% Lysine content using Maize Meal, Soya bean meal and a mineral/vitamin premix (**8 marks**). You are provided with the information that the content of Lysine in Maize and Soya bean is 0.70 and 1.80%, respectively. You are also informed that the premix contains no lysine and is limited to 3% inclusion level in the diet. You are also given the information that the composition of other nutrients in Maize, Soya beans and the premix are as indicated in Table 1. What are the energy, protein, calcium and phosphorus contents of this diet? (**8 marks**). Given the information that a standard broiler starter diet must have 23% crude protein, 3200 kcal energy, 1% calcium and 0.85% phosphorus, how adequate is this formulation as far as meeting the broiler chickens nutrient requirements is concerned (**4 marks**)?

Table 1: Nutrient composition of feedstuffs required for the formulation of the Broiler Starter diet.

Ingredient	**Protein (%)**	**Energy***	**Calcium (%)**	**Phosphorus (%)**
Maize meal	9.0	3600	0.04	0.30
Soy beans meal	44.0	2900	0.30	0.65
Pig grower Premix	0.00	0.00	0.00	0.00

QUESTION TWO

Assume you have a herd of 15 milking cows averaging 400kg body weight with each producing 12 litres of milk every day that has a butter fat content of 3.0%. The animals have access to an improved grazing pasture of Rhodes grass that is 2.5 months regrowth and contains 20% dry matter (DM). The farm also has Star grass hay, which has 80% DM that is available for feeding the animals. If the animals are expected to consume 3.0% of their body weight on dry matter (DM) basis, how much feed are these animals expected to consume every day (**2 marks**)? If the

consumption of improved pasture is limited to 60% of expected intake, how much of this pasture are animals expected to consume when expressed on as fed basis (**2 marks**)? If the consumption of the Star grass hay is limited to 30% of expected dry matter intake, how much is this intake on as fed basis (**2 marks**)? If the energy concentration of improved pasture and hay are given as tabulated in Table 2, how much milk are these animals expected to produce per day by consuming the improved pasture and star grass hay (**4 marks**)? The energy and protein requirements for maintenance and milk production are given in Table 3.

Table 2: Nutrient content of Rhodes grass and Star grass Hay for milking cows

Feed ingredient	**Dry Matter (%)**	**g TDN/kg DM**	**g dCP/kg DM**
Rhodes grass	20	590	50
Star grass Hay	80	520	45

Table 3: Energy and protein requirements of milking cows for maintenance and per litre or kg milk production

Animal Nutritional Requirements			**Milk Production Requirements**		
Body Weight (kg)	*Energy (TDNg)*	*Protein (g dCP)*	*% Butter fat*	*Energy - TDN(g)*	*Protein (g dCP)*
400	3100	250	3.0	355	48
450	3400	270	3.5	415	51
500	3700	290	4.0	470	56
550	4300	310	4.5	550	63

To improve milk production, formulate a concentrate diet that has 150 g dCP using Maize bran, Sorghum and Cotton Seed Cake based on energy and protein concentrations given in Table 4 (**4 marks**)? What is the energy content of this concentrate (**2 marks**)? If the consumption of this concentrate diet is limited to 10% of expected dry matter intake; how much of this concentrate are each of the animals expected to consume each day (**2 marks**)? How much milk will the animals produce every day as a result of consuming all the available feeds on the farm (**2 marks**)?

Table 4: True digestible nutrients and crude protein contents (g/kg) on dry matter basis in Maize bran, barley and cotton seed cake required for the formulation of the required dairy concentrate.

Ingredient	**Total Digestible Nutrients**	**Digestible Crude Protein**
Maize Bran	650	110
Barley	800	100
Cotton Seed Cake	750	300

QUESTION THREE

List some of the main factors that limit increased utilization of tropical feed ingredients into ration formulation (**8 marks**)? Why is it important to formulate proper rations for animals on any farm (**8 marks**)? How can you ensure quality control in your ration formulation and animal feeding regimes (**4 marks**)?

QUESTION FOUR

An orphan beef calf to be artificially reared should have access to colostrums within the first 12-36hrs of its life. Explain with three reasons the importance of this milk to the calf (**12 Marks**). Why is it important for the calf to take this milk within the 12-36hrs after birth? (**8 Marks**).

QUESTION FIVE

Urea is fed to ruminants as a non-protein nitrogen source for rumen bacteria. Explain with a diagram how a cow recycles the nitrogen from this feedstuff that is not unutilitised by the rumen bacteria for microbial protein synthesis (**10 Marks**). If urea is consumed by the animals in excess, it usually causes poisoning. Explain how urea poisoning occurs (**10 Marks**)

QUESTION SIX

(a) Hay, maize silage, fish meal, green chops, oilseed cakes, sweet sorghum silage, beef tallow, soybean oil, maize meal, cassava tubers are all feedstuffs that can be used to feed goats. Group these feedstuffs into the following classes, and list down at least three characteristics of feedstuffs in these classes

(i) Energy concentrates **(5 Marks)**

(ii) Protein concentrates **(5 Marks)**

(b) Explain why each of the following feedstuffs may be added to a feed for farm animals;

(i) Fats **(2 Marks)**

(ii) Antioxidants **(2 Marks)**

(iii) Antibiotics **(2 Marks)**

(iv) Abortifacients **(2 Marks)**

(v) Molasses **(2 Marks)**

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2013/14 ACADEMIC YEAR – FIRST HALF EXAMINATIONS

COURSE AGA 4311 – PRINCIPLES OF 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) In ***Drosophila melanogaster***, white eyes (w), miniature wing (m) and forked bristles (f) are sex linked and recessive to the wild type characters red eyes, long wings and straight bristles. In a cross between a triple homozygous females and a wild type male, the F1 females were mated to males having white eyes, miniature wings and forked bristles. The progeny of this second cross are listed below, counting males and females together:

White, forked, miniature	26.8%
Red, straight, long	26.8%
White, straight, long	13.2%
Red, forked, miniature	13.2%
White, straight, miniature	6.7%
Red, forked, long	6.7%
White, forked, long	3.3%
Red, straight, miniature	3.3%

What were the genotypes of the original male and female parents and the F1 females? Designate the non-crossovers, single crossovers and double crossovers. What is the sequence of these linked genes in the chromosome? Calculate the map distance between the genes and the coefficient of coincidence. Comment on the answer you get.

b) Assume that in a randomly mating and closely population, the frequencies of BB = 34%, Bb = 40% and Bb = 26%. Is this population at Hardy-Weinberg Equilibrium? State the Hardy-Weinberg Law.

Q. 2 Write notes on any four (4) of the following:

a) Epistasis;
b) Recombination;
c) Mutation and mutagens;

d) Multiple alleles and co-dominance; and
e) Sex-determination and sex linkage.

Q. 3 Outline the structure of Deoxyribonucleic Acid (DNA) in relation to its function as a carrier of genetic information. How is the genetic information translated into the sequence of amino acids in proteins?

Q. 4 a) Explain the sequence of events that take place during Prophase I of Meiosis and indicate their genetic consequences.

b) The components of variance for two characters of ***D. melanogaster*** are shown in the following table. Estimate the dominance and epistatic components and calculate heritabilities in the narrow and broad sense.

Variance Components	Thorax Length	Eggs Laid in 4 Days
Vp	100	100
Va	43	18
VE	51	38
Vd + Vi	?	?

Q. 5 a) The following are milk yields (y) in tones from 10 dairy cows and corresponding are the mean monthly rainfall figures in millimeters (x):

Rainfall (X)	Milk Yield (Y)
4	6
3	4
4	4
6	10
6	9
5	7
4	6
5	8
4	5
2	4

With the use of the graph paper provided, plot a scatter diagram to the relationship that exists between monthly rainfall and milk yield. Calculate the correlation coefficient between monthly rainfall and milk yield

b) Write notes on the types of mutations and their effect.

Q. 6 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 0.8, what are the expected frequency of phenotypes from a test cross whose progeny are 1000?

b) A non-statistical approach may be used to calculate the heritability of the desired traits. What is the approach? With the help of an example illustrate how the heritability of trait of your choice may be calculated.

END OF EXAMINATION

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THE SCHOOL OF AGRICULTURAL SCIENCES

2013/14 ACADEMIC YEAR MID –TERM EXAMINATIONS

COURSE AGA 4511 – BEEF AND SMALL RUMINANT PRODUCTION

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

a) All Questions carry equal marks (20).
b) Answer any **five (5)** questions.
c) Use different answer books for each Section.

SECTION A – BEFF PRODUCTION:

Q. 1 In 2012 a farmer in Kalomo bought 2 Tonga bulls 6 oxen, 55 Angoni cows. 4 He-goats, 20 does, 5 rams and 30 ewes. The cows started calving on 14th September 2013 and the last cow calved on 30th November 2013. The number of calves that were born were 27 male and 20 female.

a. Comment on the performance of the beef herd based on the following parameters (please show the calculations where necessary to support your answer):

i) Breeding Ratio,
ii) Breeding system,
iii) Calving percentage, and
iv) Breeding season (14 marks).

b. What are the major threats to the survival of the local cattle breeds in Zambia?

c. What are the benefits of inclusion of exotic cattle breeds in the beef industry in Zambia?

Q. 2 a. Mention and explain the factors to consider when selecting the type of animal species to be used for animal draft power (5 marks).

b. Cattle have been a source of animal draft power for a long time. Mention and explain the important factors to consider when selecting cattle for animal draft power in Zambia (5 marks).

c. The introduction of donkey traction into Zambian small scale farming communities has received a very positive response. The current social and economic difficulties faced by small-scale farmers have made the donkey an important resource in agricultural production. Why has the use of donkeys for animal draft power in Zambia received the positive response. What are some of the drawbacks of using the donkey for draft power compared to other animal species (marks 10).

Q. 3 a. Mention and describe the different systems of beef rearing in your country.

b. what are the general management practices that important in beef production and why should they be carried out?

SECTION B – SMALL RUMINANT PRODUCTION:

Q. 4 Upon graduating from the University of Zambia you have been employed as a Farm Manager of an intensive sheep and goat farm in Lusaka West. Discuss any ten (10) lamb and kid routine management practices that you would put in place to ensure that the Sheep and Goat Farm operates profitably.

Q. 5 The breeding management of sheep and goats will determine their profitability. Discuss the sheep and goats breeding seasons that can be used in Zambia with respect to different the levels of management. Also give one breed of sheep and goats that could be reared with respect to different the levels of management.

Q. 6 Sheep prefer to graze close to the ground whereas goats prefer browsing. Therefore, they do not compete for the same type of feed. This results in an efficient utilisation of available herbage. Discuss the factors that may affect the dry matter intake (DMI) of sheep and goats being reared at UNZA's Liempe Farm.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2014 END OF ACADEMIC YEAR EXAMINATIONS

COURSE AGA 4522 – Dairy and Rabbit Production

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

a) All Questions carry equal marks (20).
b) Answer any **five (5)** questions.
c) Use different answer books for each Section.

SECTION A – Dairy Production

Q. 1 In dairy management, it is often said management is based on individual animals rather than managing the whole herd.

a. Explain the importance of animal identification and record keeping in dairy management (6 Marks).

b. List some of the important records that must be kept or maintained on a dairy farm (14 Marks).

Q. 2 a. What is dairy hygiene and why is it important on the farm? (4 Marks)

b. What are some of the key considerations that a farm manager needs to institute to ensure hygiene is maintained on the farm? (10 Marks)

b. Milk on the farm is priced based on quality. What are some of the key tests for quality you need to undertake to make sure you market good quality milk from your farm? (4 Marks)

Q. 3 Artificial insemination and embryo transfer are reproductive technologies that are used to increase production and productivity of a dairy herd. A retiree farmer is planning to adopt one of these technologies for his herd but decides to consult you first. Explain with at least five reasons why he/she should adopt the technology of your choice (20 Marks).

Q. 4 a. Define the following terms used in dairy production:

(i)	Lactation curve	(2 Marks)
(ii)	Breed conformation	(2 Marks)
(iii)	Challenge feeding	(2 Marks)
(iv)	Milk persistence	(2 Marks)
(v)	Body condition score	(2 Marks)

b. Zambia is endowed with favourable conditions for dairying. However, the sector has still remained undeveloped. With 4 reasons, explain why dairying has not yet developed (8 marks)

c. Explain the importance of a large rumen characteristic in a dairy animal (2 marks)

SECTION B – Rabbit Production

Q. 5 As a recent graduate from the University of Zambia, you have been appointed a Farm Manager at a mixed farm that includes a Rabbit Unit. With your knowledge that a good breeding routine will ensure the profitability of the rabbit unit enterprise, discuss any ten (10) good breeding practices that you should immediately put in place (20 Marks).

Q. 6 With reference to Q. 5 above:

a. Design a individual Hutch and Breeding Record Card to assist improve the management of the Rabbit Unit (10 Marks); and

b. Discuss the possible sources of breeding stock to start a Rabbit Unit and the factors to look for when selecting the breeding stock (10 Marks).

End of Examination

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2013 ACADEMIC YEAR:
FINAL EXAMINATIONS

AGA 4531: INTRODUCTION TO AQUACULTURE
THEORY PAPER

TIME: THREE HOURS

INSTRUCTIONS: ANSWER **FIVE** QUESTIONS: QUESTIONS **1 SECTION A** AND QUESTION **5 IN SECTIO B** ARE COMPULSORY: ANSWER **TWO** QUESTIONS FROM **EACH** SECTION AND A **FIFTH** QUESTION FROM **EITHER** SECTION. USE **SEPERATE** EXAMINATION ANSWER BOOKS FOR **EACH** SECTION

SECTION A

1. A fish that deposits annual rings was caught when total length was 38.0 cm with scale radius of 5cm. Radius lengths for each annulus at different ages are given in Table 1 below.

Table 1 showing annual rigs lengths at different ages

Age (Years)	Length (cm)
1	2.2
2	3.8
3	4.7

Given following relationship

$$L_n = (S_n \times L)/S$$

(a) Estimate fish lengths at ages of 1, 2 and 3 years.
(b) Summarise advantages of the use of annual rigs compared to tank or pond experiments.
(c) Describe advantages of the method in (a) above compared to the recapture method in determining fish growth.

2. Summarise the following terms and concepts in relation to fish growth, taxonomy or anatomy:
(a) Asymptotic length.
(b) Fulton's Condition Factor.
(c) Type specimen.
(d) Mochokidae.
(e) Caudal peduncle.

TURN OVER

3. (a) Summarise key characteristics of the family Clariidae.
   (b) Name two Clariid species and highlight the significance of the family in aquaculture and capture fisheries.
   (c) Describe advantages and difficulties associated with culturing Clariids.

4. (a) Describe the two lineages of the family Cichlidae.
   (b) Name four Cichlid species common in Zambia and highlight the significance of each one either in aquaculture or capture fisheries.
   (c) Summarise useful and problematic characteristics of Cichlid in fish farming.

SECTION B

5. (a) Give an account of the spawning behaviour of *Tilapia rendalli* and *Oreochromis niloticus*.
   (b) Describe similarities and differences between the two species in (a) above.

6. Discuss the methods that a Tilapia fish farmer is likely to use in order to control its prolific reproduction behaviour.

7. Describe reproductive systems in fish.

8. Discuss the factors that farmers in your community will consider in order to embark on Tilapia farming.

END OF THE EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
ANIMAL SCIENCE DEPARTMENT

2013/2014 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS

COURSE AGA 4532: PIG AND POULTRY PRODUCTION

DATE OF EXAMINATION: 29TH JULY, 2014

DURATION: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

i. **Answer all questions.**
ii. **Marks for each question are as shown.**
iii. **Write the answers for each Section in separate answer books and mark books appropriately as Section A or B.**

SECTION A POULTRY PRODUCTION

Q1. Write briefly on the following: **(20 marks)**

i. Conditions necessary for the successful incubation of eggs.
ii. Standard cleaning procedure of a poultry house before disinfection
iii. Moulting and its effect on performance in layers.
iv. The reasons for rearing quails in cages.

Q2. **(20 marks)**

Imagine you are the Animal Production Officer for Chizera District. One of your duties is to supervise broiler production activities in the district. The chairperson of a broiler unit (Tunvwanganai Production Unit) invites you to her group's chicken run. Outside the chicken run you see pools of stagnant water everywhere left by the rain. At the door of the building you are met with an irritating pungent smell coming from inside. Inside the building you 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 have stains in different variations of the colour red. The chairperson informs you that out of an initial 500 chicks, 127 have so far died.

i. What is your assessment of the management and care of the birds and their environment?
ii. What biochemical processes do you expect to be taking place in the birds, in relation to your observations?
iii. What advice would you give the chairperson of Tunvwanganai Production Unit and her group members on the management of the broilers?

Q3. Compare and contrast the management of chickens reared under the 'traditional 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 birds? **(20 marks)**

SECTION B PIG PRODUCTION

Q1 Write on the main factors that should be considered in the housing of new-born piglets. **(15 marks)**

Q2 List and explain the most important stress-related factors that can affect the performance of growing pigs **(10 marks)**

Q3 What factors must be considered when deciding on the number of boars required for a pig enterprise? **(15 marks)**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURE

2013 ACADEMIC YEAR
FINAL EXAMINATIONS

AGA4542: GAME RANCHING

TIME: THREE HOURS

INSTRUCTIONS: ANSWER **FIVE** QUESTIONS. ANSWER QUESTION **ONE** AND ANY OTHER **FOUR** QUESTIONS. USE ILLUSTRATIONS WHERE NECESSARY.

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1. Samaki Farms Ltd is considering establishing a game ranch in the Mumbwa District along the Kafue River. Initial investigations show that the range is suitable for Impala, Zebra, Wildebeest, Kudu and Buffalo. Ten per cent (15%) of the range is a steep hill and in addition only 60% of the range is within 6.5 km from water. Based on the information from the Ministry of Agriculture and Cooperatives in Mumbwa, the soils are generally suitable for game ranching. Furthermore, results from your preliminary estimates indicate that the production of key forage species averages about 800kg/ha of dry matter per year. The proposed farm is 10,000 ha in size. Assuming that allowable use is 40% of the total biomass and daily dry matter intake is 2% of the animal body weight,
   (a) Determine the number of 950 kg buffaloes you would stock as your base herd in the area.
   (b) Determine Animal Units / ha/month of the buffalo.
   (c) Determine number of hectares you would need to stock200 zebras per year in this ranch.
   (d) Discuss limitations of this method in estimating stocking rate of wildlife species.

2. Discuss each of the following:
   (a) Animal species suitability for a game farm in Zambia.
   (b) Difficulties associated with the translocation and restocking operations in Game Ranching.

3. Discuss management application of the following methods as used in wildlife and range management:
   (a) Bitterlich method.
   (b) King Census method.
   (c) Point centered quarter method.
   (d) Point-intercept method.

TURN OVER

4. (a) Compare and contrast the concepts of carrying capacity and stocking rate in the management of wildlife species.
   (b) Describe methods for wildlife habitat improvement in a semi-arid environment

5. Summarize each of the following:
   (a) *Ceratotherium simum.*
   (b) Contribution by Aldo Leopold.
   (c) Aerial census.
   (d) Artiodactyla.

6. Discuss each of the following:
   (a) Main characteristics of a wildlife habitat.
   (b) Restoration of *Tragelaphus spekei*habitat.

7. Describe the method used to determine:
   (a) $1 - e^{-H}$ in the exploitation of wildlife populations
   (b) Quotas for harvesting wildlife species.

8. Discuss each of the following:
   (a) Kidney/Fat ratio.
   (b) Limitation of Maximum Sustainable Yield.
   (c) Protected Area System in Zambia
   (d) Limitations of Community Based Natural Resources Management

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END OF EXAMINATION

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

SECOND SEMESTER FINAL EXAMINATIONS

COURSE : **AGA 4552/552 ANIMAL PRODUCTS AND BY-PRODUCTS**

DATE : **WEDNESDAY 23RD JULY 2014 14:00 HOURS**

DURATION : **3 HOURS**

TOTAL MARKS : **100**

INSTRUCTIONS : **ANSWER QUESTIONS ANY FIVE QUESTIONS**

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1. In a well-bled animal, myoglobin constitutes 80-90 percent of the total meat pigments. The ultimate colour of fresh meat therefore is dependent on the myoglobin content of muscle fibers and the oxidation state of Iron present in the myoglobin porphyrin ring. Explain in detail the factors that influences myoglobin content of the meat.(20 marks)

2. Force Summation describes the addition of individual twitch contractions to increase the intensity of overall muscle contraction. This can be achieved in two ways: by multiple fiber summation, and frequency summation. Write short notes on;
    a. Multiple fiber summation
    b. Frequency summation (20 marks)

3.
    a. Explain with aid of a flow diagram the manufacturing process of ripened cheese. (12 marks)

    b. As a leading consultant of Siliko Consulting Ltd, you are approached by the Production Manager of Mubiana Dairy Products Ltd who has a problem of bulging yogurt cups after several days of storage. Explain the possible causes and offer possible solutions. (8 marks)

4.

a. Explain the significance of heat treatment in milk processing and give three types used for consumption milk processing with their respective temperature-time combinations. (10 marks)

b. Define mastitis and describe its effect on milk composition. (5 marks)

c. Describe the churning process in butter making and state its importance. (5 marks)

5. Mr Mungili has decided to venture into egg production upon seeing how successful his neighbour was in the same venture. He acquired 700 layers and when he started taking his eggs to the market the customers were complaining that his eggs were small compared to other producers.
   a. Mention and explain the possible causes of the small eggs he is producing and what would be your advice (10 marks).
   b. Other than the eggs being small there are other deviations from normal or abnormalities in egg that can occur during production. Explain to him common egg abnormalities that can occur in laying chickens (10 marks).

6.

a. In Zambia, more than 80% of cattle and more than 90% of goats are produced by smallholder farmers. This means that there should be more hides and skins coming from this sector than from the large commercial sector. However most of the skins and hides from traditional sectors are wasted every year. What are the different defects and faults that occur in skins and hides before the final desired product leather is formed. (16 marks).

b. Outline the importance of the following by-products in the livestock industry. What are some of the problems associated with the use of these products?
   i) meat meal ii) Meat the bone meal iii) Blood meal (4 marks).

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
ANIMAL SCIENCE DEPARTMENT

2013/2014 ACADEMIC YEAR FIRST HALF FINAL EXAMINATIONS

COURSE: AGA 511 - TECHNIQUES IN ANIMAL SCIENCE

DATE: 27TH FEBRUARY, 2014

DURATION: THREE (3) HOURS

INSTRUCTIONS:

i. ANSWER ONE QUESTION FROM SECTION I AND ALL THE QUESTIONS IN SECTIONS II TO V
ii. WRITE THE ANSWERS FOR EACH SECTION IN A SEPARATE ANSWER BOOKLET

Section I: Enterprise Development, Feeding Standards and Regulations, Sampling
Answer Question 1 or 2 from this section.

1. Imagine you are the supervising officer for animal production in the Copperbelt Province and you receive a directive from Ministry of Agriculture and Livestock Headquarters to compare the nutrient content of Zambian broiler feeds on the Copperbelt with those for Lusaka Province Feed Manufacturers.
   a) Your first task is to collect samples from the dispatch sheds of the feed manufacturing plants.
      i. Explain the sampling plan you would utilize to collect representative samples from the stacks of 50kg bags you would find in the sheds. **(10 marks)**
      ii. Explain briefly, with reasons, on how you would store the collected broiler feed samples. **(5 marks)**
   b) Your second task is to have the samples analyzed using Proximate Analysis.
      1. Which nutrients have a maximum content requirement and which ones have a minimum content requirement as mandated by the Zambia Bureau of Standards for Poultry Feeds? **(5 marks)**

2. After the 2013 outbreak of Swine Fever reduced the pig population, you as the National Officer responsible for 'Pig Production Improvement', have been given the responsibility to establish a pig production unit with 500 sows in order to improve on the availability of pigs as breeding stock for the ever-increasing demand by farmers planning to engage in pig rearing ventures.

i. Write on 10 factors you would consider in setting up the piggery. **(10 Marks)**
ii. Outline the stages you expect to take the enterprise through toward its establishment, giving a summary of activities for each stage. **(10 Marks)**

Section II: Principles of Research Design, Project Proposal writing (20 marks)

1. Discuss four main principles of research.

Section III: Animal Body Condition Scoring (20 marks)

Body Condition Scoring (BCS) is useful in monitoring the extent to which cattle are affected by nutrition, disease and other environmental factors. However, Body Condition Scoring is a subjective assessment.

a) What would be the body condition scores of beef cattle in Figures 1, 2 and 3? What are the factors that you took into consideration to arrive at the Body Condition scores?
b) Why would you personally prefer to use BCS instead of physically measuring weight changes in beef cattle?
c) Which are the most important stages to body condition score beef cattle and what should be target scores?
d) What would be the most important stages to body condition dairy cattle? Give reasons for your answer.

Section IV: Animal Draft Power (20 marks)

1. It is very important to have the correct type of animal specie(s) to be used for draft power on the farm.
    i. Outline the factors to consider when selecting the correct species. Please give examples.
    ii. What animal specie (s) would you recommend for use by the small scale farmers in Zambia and why these species?
2. What argument would you put forth to encourage traditional farmers to use cows for draft power and what are some of the things that they should take into account when using the cows for draft power.

Section V: Techniques in Animal Research (20 marks)

a) Explain in detail how you would proceed to evaluate the quality of a number of pasture crops as fodder forages for ruminants using Nylon Bag Techniques. **(10 marks)**
b) What are some of the advantages and disadvantages of using the Nylon bag techniques? **(6 marks)**
c) How does the Nylon bag technique (*in sacco*) differ from the Menke in vivo gas production technique **(4 marks)**

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

FINAL EXAMINATIONS : FIRST HALF-YEAR 2013/14
COURSE: AGA 521 APPLIED ANIMAL REPRODUCTION
DURATION: THREE (3) HOURS

INSTRUCTIONS:
- **ANSWER EACH SECTION IN A SEPARATE ANSWER BOOKLET**
- **CAREFULLY READ INSTRUCTIONS FOR EACH SECTION**
- **BEGIN EACH QUESTION ON A NEW PAGE, AND,**
- **INDICATE THE NUMBER OF EACH QUESTION ATTEMPTED**

SECTION A

INSTRUCTIONS: **ANSWER QUESTION ONE** AND **EITHER QUESTION TWO** OR **THREE IN THIS SECTION**

QUESTION ONE

A) What role does each of the following products or terms play in animal reproduction? [20]

i. Foley catheter
ii. FSH
iii. Clone
iv. Estrumate®
v. PRID®

B) Modern biotechnology presents an option for improvement of domestic animal productivity.

i. How does modern biotechnology as applied in the production of dolly the sheep differ from that applied in the production of genetically modified maize? [5]

ii. Discuss two recorded concerns associated with use of modern biotechnology in domestic animals? [5]

QUESTION TWO

A) With the aid of a diagram describe follicular dynamics as they occur in an oestrous cycle of cattle. Indicate the landmark stages in follicular dynamics. [15]

B) Discuss three methods of oestrous synchronization used in domestic animals and for each one explain the basis for its use. [15]

QUESTION THREE

A) With regard to maternal recognition of pregnancy (MRP);

i. Discuss two secretory factors responsible for MRP in domestic animals [10]
ii. How does a sow compare with other domestic animals with regard to prostaglandin utilization during MRP? [5]

B) A farmer calls you requesting assistance to establish which of his cows are pregnant.

i. State two methods you would use if the last recorded oestrus was 45 days ago. [5]
ii. What is your rationale for using each of the selected methods? [5]
iii. A cow has 70-120 placentomes. What is the role of these structures? [5]

SECTION B

INSTRUCTIONS: ANSWER BOTH QUESTIONS IN THIS SECTION

QUESTION ONE

With regard to artificial insemination (AI),

i) It is a tool that can help in the acceleration of livestock improvement in Zambia. Explain how AI can accelerate Livestock improvement. (8)

ii) All semen from bulls is given an initial laboratory evaluation. Outline how this evaluation of Semen is done. (12)

QUESTION TWO

i) Explain four causes of reproductive failure in livestock in Zambia and for each state how the cause can be corrected? (20)

END OF EXAMINATION – GOOD LUCK – BOONE CHANCE

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

FINAL EXAMINATIONS SECOND HALF OF 2013 ACADEMIC YEAR

COURSE:	AGA 562: ANIMAL BREEDING
DURATION:	THREE (3) HOURS
TOTAL MARKS	100
INSTRUCTIONS:	ANSWER ALL THE QUESTIONS

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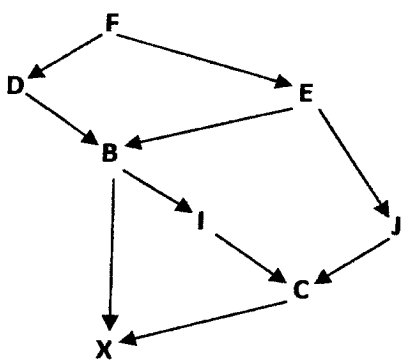
1. A famer has a flock of 110 sheep. 10 of these are males and 100 are females. Based on weight of lamb weaned, five (5) males and 90 females are selected to be parents for the next generation. The overall flock mean weight of lamb weaned is 15 kg. The mean weight of lamb weaned for the selected males is 25 kg while that for the selected females is 20 kg. It is known that the phenotypic standard deviation is 5 kg while the additive genetic standard deviation is 3 kg for this trait. It is also known that the generation interval in sheep is 4 years. What would be the expected genetic gain per year for the weight of lamb weaned based on this selection. (25 Marks)

2. A farmer had a closed herd of goats which consisted of three (3) males and fifty (50) females and they were randomly mating. What would be the expected rate of inbreeding per generation in this population? (5 Marks)

A framer would like to buy a cow (X) which has the following pedigree information. She comes to you to find out how inbred is the cow. What would you tell her? (20 Marks)



3. A farmer has three bulls in a herd. He would like to keep (select) one for breeding. He is interested in improving two traits at the same time, namely, weaning weight and pre-weaning weight gain. It is known that heritability of weaning weight and pre-weaning weight gain are 40% and 30%, respectively. It is also known that the genetic correlation and phenotypic correlation between these two traits are 0.98 and 0.97, respectively, while phenotypic standard deviations for weaning weight and pre-weaning weight gain are 26 kg and 0.15 kg/day, respectively. The profit margin per unit increase in weaning weight is one (1) kwacha while that for pre-weaning weight gain is two (2) kwacha. The farmer provides you with the following data on weaning weight and pre-weaning weight gain of the three bulls. Which bull would you recommend to be kept (selected)? (30 Marks)

BULL	Weaning Weight (kg)	Pre-weaning weight gain (kg/day)
A	40	0.15
K	42	0.10
Q	39	0.20

4. The following is the Analysis of Variance for Back-fat Thickness in pigs at 154 days of age. Estimate the heritability of this trait from a) Sire variance component; b) Dam variance component; and Sire and dam variance component. (20 Marks)

Source of Variation	Degrees of freedom	Mean Squares	Expected Mean Squares
Among Sires	342	1.1561	$\sigma^2_e + 6.59\sigma^2_d + 18.16\sigma^2_s$
Among dams within sire	734	0.7529	$\sigma^2_e + 6.59\sigma^2_d$
Among full sibs	6514	0.1471	σ^2_e
Total	7590		

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE
2013/2014 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATION

AGA 5712: 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. Briefly discuss the diagnosis, transmission and prevention/control measures for each of the following diseases:
   a) Contagious bovine pleuropneumonia (CBPP) (**10 marks**)
   b) Avian influenza **(10 marks)**

2. Write short and concise/informative notes on any **four (4)** of the following:
   a) Clinical signs and postmortem lesions of Newcatsle disease in broilers **(5 marks)**
   b) Control of aspergillosis **(5 marks)**
   c) Diagnosis of Marek's disease **(5 marks)**
   d) Clinical signs and postmortem lesions of bovine tuberculosis **(5marks)**
   e) Diagnosis of swine erysipelas **(5 marks)**
   f) Control of brucellosis in cattle **(5 marks)**

3. You are employed on a big ranching and cropping establishment keeping both cattle and small ruminants. As you are the person in charge of the livestock section, one of your duties is recognition of parasitic infections and their control.
   a) Briefly outline the parasites you would be worried about for small ruminants. **(4 marks)**
   b) Describe a control programme you would put in place to control and prevent the occurrence of parasites among the small ruminants. **(12 marks)**

c) You are faced with an outbreak of the Barber pole worm and deworming is your only option to control the outbreak. Briefly outline how best you would carry out the deworming of the small ruminants taking into consideration possibility of development of anthelmintic resistance. **(4 marks)**

4. 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)**

5. Write concise notes on the following:
   a) Clinical signs and treatment of of Cowdriosis.**(5 marks)**
   b) Diagnosis and control of Anaplasmosis. **(5 marks)**
   c) Transmission and postmortem signs of Theileriosis. **(5 marks)**
   d) Postmortem signs and diagnosis Bovine Babesiosis. **(5 marks)**

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END OF EXAMINATION

The University of Zambia
School of Agricultural Sciences
Department of Plant Science
Second Year Examinations for the Bachelor of Agricultural Sciences
AGC 2010: Fundamentals of Crop Production
Final Examinations 2013/2014

Date: 16th July, 2014 **Time: 09:00 –12:00 hrs** **Venue: Omnia 1 & 2**

INSTRUCTIONS:

1. **Answer ALL questions**
2. **Marks as indicated**

QUESTION 1 (15 Marks)

a) Why is the soil moisture determination with a Neutron probe not carried out at soil depth not less than 15 cm? (**3 marks**)
b) What are the abiotic factors affecting photosynthesis? (**3 marks**)
c) Explain how improved fallows contribute to increased maize yields. (**3 marks**)
d) Describe how Centers of origin or diversity of plants are distinguished. (**3 marks**)
e) Briefly describe how external and endogenous (phytohormones) factors affect the plant development stage of Embryonic Phase (**3 marks**)

QUESTION 2 (25 Marks)

i) What is Reference Evapotranspiration? (**2 marks**)
ii) Briefly describe the two most comprehensive methods for determining Reference Evapotranspiration and explain why they are comprehensive. (**4 marks**)
iii) What is root zone water balance? (**4 marks**)
iv) Calculate the average evapotranspiration if the rainfall over a 10 day period was 13 mm and a farmer has irrigated her crop with 9 mm water, assuming drainage of 2 mm and negligible runoff. (**9 marks**)
v) What was the stage of crop development and time of the year the measurements were taken? (**6 marks**)

Given:

Rainfall over a 10 day period	=	13 mm
Irrigation applied by the farmer	=	9 mm
Drainage	=	2 mm
Soil water storage	=	80 mm
Reference Evapotranspiration	=	9 mm

Runoff was insignificant

QUESTION 3 (20 Marks)

i) Explain the reduced yield of some of the maize lines and varieties in the Maize Mother-Baby trials which you visited in Palabana on 30th May, 2014. The performance of the maize genotypes is shown in Table 1 below. Relate the performance of the maize lines and varieties to your observations in growing your crops in nutrient solutions (hydroponics). **(10 marks)**

Table 1: Yield performance of maize lines and varieties at Palabana

MAIZE LINE/VARIETY	YIELD (KG/HA)	MAIZE LINE/VARIETY	YIELD (KG/HA)
13CZ1057	5426	CZH 0837	3564
GV 659	4742	MMV 420	3548
ZARICZH 055	4141	ZARICZH 113	3090
ZAR07SADVL	4141	ZM 621	3083
ZMS 623	3674	GV 628	2997
GV 638	3626	GV 664A	2394

ii) You are a space traveller travelling to Mars, a journey which takes about 9 months. What materials and conditions would you require and how would you go about to grow your own food on Mars? **(10 marks)**

QUESTION 4 (20 MARKS)

a. Outline the rules of writing scientific names of plant species. **(4 marks)**

b. You have been called to advise students in correct way of writing plant species scientific names. One student wrote the name of a plant species as voandzeia subterranean (Thou.). Linnaeus.

   (i) Mention the rule(s) of writing scientific names which has been violated by the student. **(4 marks)**

   (ii) What is the common name for this plant species? **(1 mark)**

   (iii) What is the correct scientific name for this plant species? **(1 mark)**

   (iv) What is the genus name for this plant species? **(1 mark)**

   (v) Who is the first scientist to describe and classify this plant species? **(1 mark)**

c. Using one crop from Poaceae, Solanaceae, Cruciferae and Papilionoideae family;

   (i) What are their centres of origin? **(2 marks)**

   (ii) What are two of their economic importance to the nation? **(2 marks)**

d. List the divisions of plants based on very broad grouping of uniformity and true tissue. **(4 marks)**

QUESTION 5 (20 MARKS)

a. Explain how the components of plant development and evolution influence plant morphology **(6 marks)**

b. What are external plant structures and how can they be used to group plants? **(4 marks)**

c. Biotechnology is a major crop improvement method which can be used to improve desirable traits in plant species of economic importance. Suggest how you would use one biotechnology option to make Cassava planting material free of viruses and make their availability quick to famers. **(10 marks)**

END OF EXAM

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF PLANT SCIENCE

Third Year Examination for Bachelor of Agricultural Sciences

AGC 3342: Crop Protection

2013/14 Final Examination

Date: 16th July, 2014 **Time: 09:00 – 12:00 hrs** **Venue: GLT**

Instructions:

- There are three (3)sections in this Examination Paper
- Each section should be answered in a **separate answer booklet**
- Answer **Any Two (2)** question from Section A and **Both (2)** questions from Section B and C
- You are required to answer a total of 6 questions

SECTION A (20 MARKS): PATHOLOGY- ANSWER ANY TWO QUESTIONS

Question 1

a) Describe how Witchweed (*Striga spp)* causes parasitism in higher plants, clearly highlighting the mechanisms used. **(6 marks)**

b) Explain ways in which viruses can be transmitted in plants. **(4 marks)**

Question 2

a) Illustrating with appropriate examples, discuss any four shapes associated with particle morphology classification in viruses. **(6 marks)**

b) Explain any four factors that accounts for the success of the plant pathogenic fungi **(4 marks)**

Question 3

a. Explain the differences between a sign and a symptom with reference to plant disease diagnosis. **(3 marks)**

b. Explain how nematodes cause diseases and list symptoms associated with nematode attack or inversion on plants **(5 marks)**

c. List four (4) symptoms associated with non-infectious disorders in plants. **(2 marks)**

SECTION B (20 MARKS): ENTOMOLOGY- ANSWER BOTH QUESTIONS

Question 4

We seldom stop to consider what life would be like without insects and how much we depend on them for our very survival. Discuss the benefits of insects, if any. Give relevant examples **(10 marks)**

Question 5

Define Integrated Pest Management (IPM). Suppose a farmer has adopted Integrated Pest Management programme for the insect damaging his/her crop. Explain the requirements for a successful Integrated Pest Management programme **(10 marks)**

SECTION C (20 MARKS): WEED SCIENCE- ANSWER BOTH QUESTIONS

Question 6

What is cultural control of weeds? Describe three (3) measures that constitute preventive weed control. **(10 marks)**

Question 7

a) What are the major factors determining the proliferation of aquatic weeds? **(5 marks)**

b) Give the major differences between weed control and eradication? What are ruderal weeds, give two (2) examples of such weeds (scientific names)? **(5 marks)**

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF PLANT SCIENCE
Third Year Examinations for Bachelor of Agricultural Sciences
AGC 3412 INTRODUCTORY HORTICULTURE
Third Term, 2013/2014 Academic Year

Date: 14 July 2014 **Time: 14:00 – 17:00 hrs** **Venue: OMNIA 3**

Instructions: Answer all Questions.
Marks are as indicated.

1. You have been requested to give a presentation on farm yard manure to a youth group intending to venture into horticultural production. As an Agricultural Officer for Mumbwa District, what would you include in your presentation? Give relevant examples. **(20 marks)**

2. Farmers in Shang'ombo area are growing vegetables to supply markets in Western Province. Discuss the limitations these farmers face in their vegetable production. **(20 marks)**

3. A group of potential investors from Europe would like to grow vegetables and flowers for the export market in Zambia. As a greenhouse specialist, convince these potential investors why they need to engage in greenhouse production as opposed to open field. In your answer, explain to them the considerations to be made when selecting a site for setting up a greenhouse range. **(22 marks)**

4. Describe hedge rows detailing their use in organic horticultural production and give relevant examples. **(20 marks)**

5. a. A farmer in Mpongwe intends to grow Onion (*Allium cepa*) on a commercial basis. Advise the farmer on how he should manage his irrigation in order to produce quality bulbs. **(6 marks)**

   b. A farmer suspects that her crops are being attacked by nematodes. How can you confirm her suspicion? What advice would you give? Give relevant examples. **(6 marks)**

   c. With the use of diagrams, illustrate the designs used in greenhouse construction. **(6 marks)**

End of Examination

UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Plant Science
Fourth Year Examinations for Bachelor of Agricultural Sciences
AGC 4320: Principles and Application of Entomology
Final Examination 2013/14

Date: 15th July, 2014 **Time: 09:00-12:00h** **Venue: Other Rooms**

INSTRUCTIONS: Answer ALL questions
Marks are as indicated

SECTION A: FUNDAMENTALS OF ENTOMOLOGY

QUESTION 1 (20 MARKS)

Suppose you had conducted a survey of insects available at the Field Station, UNZA and you found that all insect orders were represented. Describe the changes that would happen if you were able to eliminate all the insects from the area (Field Station).

QUESTION 2 (20 MARKS)

With aid of diagrams compare and contrast the male and female reproductive systems of insects.

QUESTION 3 (20 MARKS)

A. The pattern of insect veins varies from order to order, and even from species to species. Certain consistencies, however, make wing venation a useful tool for insect identification.
   i. There are several systems for naming wing veins, name one of the systems.
   ii. Using the named system for naming wing veins, label each of the **longitudinal veins** and **the cross veins** of the generalized insect wing shown in a diagram below (see **Figure 1**):

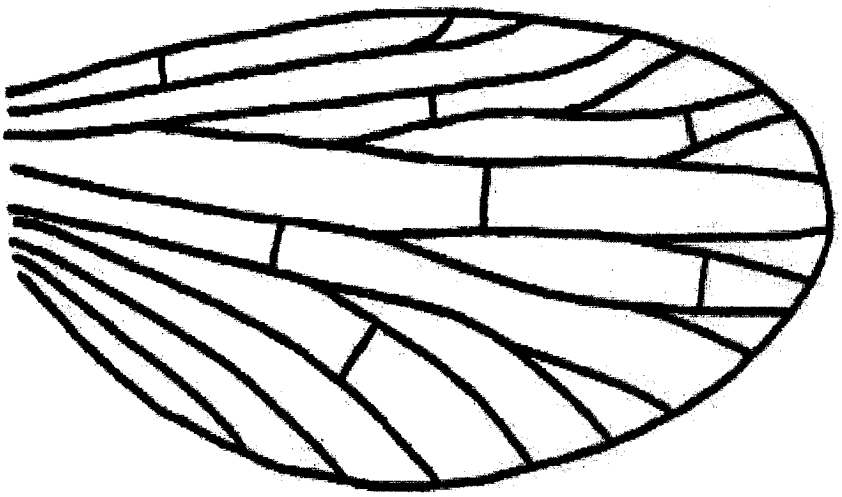

Figure 1: The generalized Insect Wing.

B. Insect wings may be adapted or modified for special functions. Write briefly about the following insect adaptations. Give examples of orders of insects that exhibit these types of wing adaptation.
   i. Tegmina
   ii. Elytra
   iii. Hemelytra
   iv. Halteres
   v. Hamuli.

SECTION B: APPLIED ENTOMOLOGY

QUESTION 4 (20 MARKS)

a. Justify how indiscriminate use of pesticides gave rise to integrated pest management.
b. Describe the four modes of entry of pesticides into the spray operator's body. Give one relevant example of insecticide for each mode of entry.

QUESTION 5 (20 MARKS)

Define biological control. Most of the insect pests we have in Zambia are exotic. Suppose there is an outbreak of one of these exotic insect pests at Liempe Farm. How would you implement the biological control programme in order to manage the exotic insect pest that has broken out? Justify your choice of method of biological control to use.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx***END OF EXAM***xxxxxxxxxxxxxxxxxxxxxxxxxxxx

The University of Zambia
School of Agricultural Sciences
Department of Plant Science
Fifth Year Examinations for the Bachelor of Agricultural Sciences
AGC 511: Aspects of Crop Production

Date: 28th February, 2014 **Time: 09:00 –12:00hrs**

Instructions:

1. **Answer all questions**

Marks as indicated

Question 1(20 Marks)

a) How is population density important in determining a farming system? (**4 Marks**)
b) What is meant by land quality and sub-quality? (**4 Marks**)
c) What are the three pillars of livelihoods? (**4 Marks**)
d) Work on improving livelihoods is guided by the definition by Chambers and Conway of livelihood, what does this definition entail?(**4 Marks**)
e) Briefly describe the external environment that influences livelihoods. (**4 Marks**)

Question 2 (20 Marks)

As a fresh graduate who has learned about the importance of improving the living standards of people in livelihood zones, you are called upon to provide technical guidance to stakeholders planning meeting to put up a multipurpose dam or an irrigation scheme. Explain the way forward if any benefits are to be obtained from the proposed multipurpose dam or irrigation scheme. (**20 Marks**)

Question 3 (20 Marks)

A good farming system has been defined basing on key components which are capable of maintaining its productivity and usefulness to society indefinitely. Explain only four (4) of key components on their capability to maintain productivity and usefulness. (**20 Marks**)

Question 4 (20 Marks)

More than one stress occurs every year in all the eighteen livelihood zones in Zambia. The occurrence can cause complete yield loss when not addressed.

a. Define stress. **(2 Marks)**
b. List three sources of biotic and three sources of abiotic stress and explain how they can affect crop productivity. **(12 Marks)**
c. In brief explain any two plant survival mechanisms that plants will use to cope with drought stress.
(6 marks)

Question 5 (20 Marks)

i) Describe the approaches used to delineate livelihood zones. **(8 Marks)**
ii) Explain the characteristics of livelihood zones 1, 16 and 11 with respect to 1. geographical location, 2. climate, 2. system description, and3. farmer typology. The livelihood zones are shown in Figure 1. **(12 Marks)**

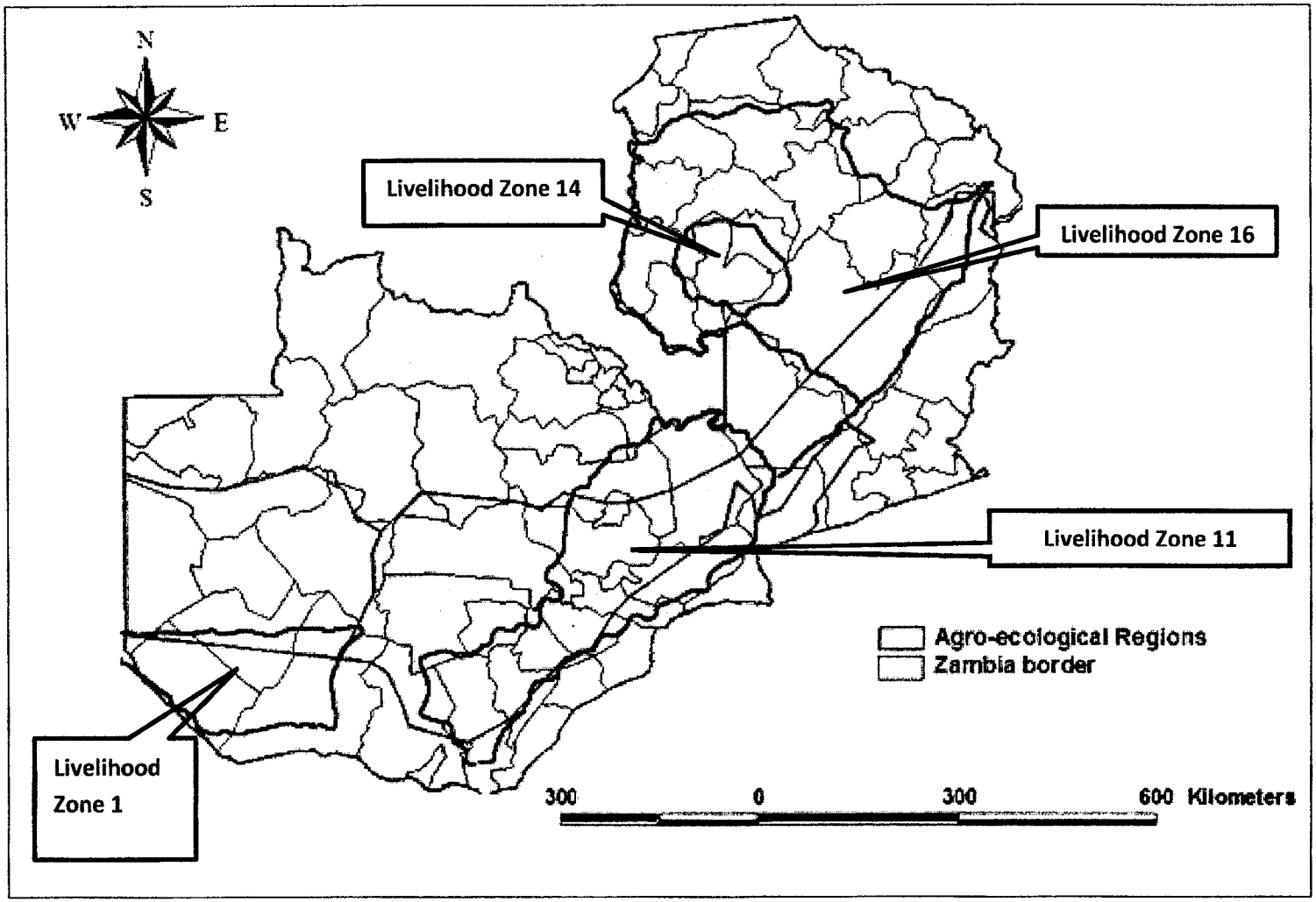

Figure 1: Livelihood Zones of Zambia

UNIVESITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
CROP SCIENCE DEPARTMENT
UNIVERSITY EXAMINATIONS

AGC 521 PLANT BREEDING II **FEBRUARY 2013**

INSTRUCTIONS: Answer FOUR Questions in total for the Examination. Points for each question are indicated in brackets.

TIME: 3 hours

SECTION A: Answer this question.

QUESTION 1 (40 marks)

(Q1 a) [24 marks]

A plant breeder assessed the inheritance for the resistance trait to *Fusarium graminearum* ear rot in Maize using an NCD II mating design. The progenies were evaluated and a partial ANOVA is shown below:

Source	DF	SS	MS	EMS
Rep	2	9.6		
Crosses	19	59.5		
GCA male	4	28.6		
GCA female	3			
SCA	12	13.5		
Error		19.8		

I. Fill in the table and determine if the contributions of GCA and SCA to the source of variance are significant

II. Determine the type of gene action conditioning the trait for resistance to *F.graminearum*

III. Calculate the broad sense (BS) and narrow sense (NS) heritability for this trait. Which of the two (BS or NS) is of great significance to a plant breeder and why

IV. What advise can be given to the Maize program with regards to selection for this trait

Q1 b [16 marks]

i. List a step by step approach involved in the identification of Quantitative trait loci (QTL) associated with the trait of interest (4 marks)

ii. Explain in a logical order how crop improvement through *Agrobacterium* mediated gene transfer can be achieved (12 marks)

SECTION B: Answer at least ONE question

Q.2 **(a)** Plant breeding involves selection as the main mode of developing superior materials. What is selection? (**5 points**). Give a clear elaboration on how you would improve selection for a trait of interest, pointing to the challenges that may be encountered? (**15 points**).

Q. 3 Using chi-square check if the given population is in equilibrium.

	WW	Ww	ww
Number of individuals	600	180	60

(20 points)

Q. 4 Discuss the five types of 'response to selection' in random mating populations clearly highlighting the genetic interpretation for each type (**(20 marks)**)

Q. 5 (a) Differentiate between general combining ability (GCA) and specific combining ability (SCA) as used in plant breeding (**6 marks**)

(b) Discuss the key features of North Carolina Design I and the Triple Test cross (**14 points**)

SECTION C: Answer any question(s).

Q. 6 Differentiate North Carolina Design I from North Carolina Design II in terms of the strategy and basic frame of the Analysis of Variance (**20 points**).

Q.7 Write short notes on the following: (**5 points each**)

a. Mating Designs used in estimating genetic variance in plant breeding
b. Characteristics of cross pollinated populations
c. Hardy-Weinberg Law and its properties
d. Key characteristics of any two methods of estimating heritability

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Plant Science
Fifth Year Examinations for Bachelor of Agricultural Sciences
AGC 542: Integrated Pest Management
Final Examination 2013/14

Date: 23rd July, 2014 **Time: 14:00-17:00h** **Venue: Omnia I**

INSTRUCTIONS: Answer ANY 4 (FOUR) questions
Marks are as indicated

QUESTION 1 (25 MARKS)

Activity of human beings which upsets the biotic balance of ecosystem is the prime cause for pest outbreak. Discuss these human interventions responsible for pest outbreaks with relevant examples.

QUESTION 2 (25 MARKS)

i. Define sprayer calibration
ii. According to Miller (2003), the best way to achieve the optimum performance from any machine is to understand how it works and the factors that influence this performance. Explain the importance of sprayer calibration.
iii. Outline the steps in calibrating a hand operated knapsack sprayer?

QUESTION 3 (25 MARKS)

1. Briefly explain the mode of action of organochlorines and carbamates to insects.
2. Discuss the five modes of action of insecticides with relevant examples.
3. Define persistent organic pollutants (POPS). Give five examples of pesticides belonging to this group.

QUESTION 4 (25 MARKS)

A. Host plant resistance plays an important role in integrated pest management.
Discuss the advantages and disadvantages of host plant resistance in integrated pest management.

B. In a quest for environmental sustainability a farmer settles for bio-control. Explain the disadvantages of bio-control as one of the tools of IPM.

QUESTION 5 (25 MARKS)

1. Distinguish between the following:
   i. r-strategists vs k-strategists
   ii. Solitary parasitoids vs gregarious parasitoids
   iii. Injury vs damage
   iv. Inoculative release vs inundative release
   v. Antibiosis vs antixenosis
   vi. Chronic toxicity vs acute toxicity
   vii. Relative sampling vs absolute sampling
   viii. Allomones vs Kairomones

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxEND OF EXAMxxxxxxxxxxxxxxxxxxxxxxxxxxx

UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Plant Science
Fifth Year Examinations for Bachelor of Agricultural Sciences
AGC 552: ADVANCED HORTICULTURE
Final Examination 2013/14

Date: 25th July, 2014 **Time: 14:00-17:00h** **Venue: Other Rooms**

INSTRUCTIONS:

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

1) Describe Commercial banana (*Musa* spp) production under the following heading key headings: common varieties, planting materials, fertiliser regimes and marketing. **[25 marks]**

2) Enumerate the main features of C_3 photosynthetic system and what are the key limitations when plants with such a system are grown in tropical and sub- tropical climates. **[25 marks]**

3) Urban horticulture or agriculture is thought to be one of the ways of dealing with food insecurity in the high population associated with urbanization. Describe what urban agriculture is and how it is practiced. Give at least 5 advantages and challenges associated with urban horticulture. **[25 marks]**

4) With reference to stem grafting as a vegetative propagation method answer the following;

   i. Critical steps followed in the propagation process,

   ii. Three (3) common fruit species it is used on and why,

   iii. Optimum climatic conditions for carrying this vegetative propagation.

   iv. Important tools and accessories used. **[25 marks]**

5) Briefly describe any 2 of the following;

   i. Control and prevention measures for three (3) diseases of citrus.

   ii. Three (3) Disease indexing methods used in plants.

   iii. Importance of Pruning and training of fruit trees. **[25 marks]**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF PLANT SCIENCE

Fifth Year Examination for Bachelor of Agricultural Sciences

AGC 562: Seed Technology

2013/14 Final Examination

Date: 15th July, 2014 **Time: 09:00 – 12:00 hrs** **Venue: GLT**

Instructions:

Answer **both (2)** questions from Section A and **any three (3)** questions from Section B

You are required to answer a total of **Five (5)** questions

SECTION A (40 MARKS): ANSWER BOTH QUESTIONS

Question 1. Write short notes on the following

a) Informal seed Sector **(4 Marks)**

b) Value for cultivation and use **(4 Marks)**

c) Secondary Seed Dormancy **(4 Marks)**

d) Pre-control plots **(4 Marks)**

Question 2

a) Differentiate between seed stratification and seed scarification **(6 marks)**

b) The initial weight of the maize seed lot at 17% moisture content is 3 Kg. At what weight should the same maize seed lot be dried to, using the 'silica gel drying method', to achieve a storage moisture content of 12%? Show all your working **(6 marks)**

c) Explain how the use of DNA molecular markers can help to achieve increased efficiency in

i) Distinctiveness of plant variety **(3 marks)**

ii) Detection of pathogens in seed health **(5 marks)**

d) List any four (4) factors affecting seed marketing **(4 marks)**

SECTION B (60 MARKS): ANSWER ANY THREE QUESTIONS

Question 3

a) Define seed vigour and list four factors that are responsible for differences in vigour **(6 marks)**

b) Discuss the certification scheme system used in Zambia (except for vegetatively propagated crops). **(14 marks)**

Question 4

a) You have been hired as a seed inspector at SCCI. What aspects would you take into consideration when evaluating a seed crop in order to effectively enforce the production standards? **(14 marks)**

b) Discuss 'Seed Priming' and 'Seed Pelleting' technologies used for seed enhancement. **(6 marks)**

Question 5

a) The newly introduce maize seed company approached you for advice on what "components of seed marketing" aspects to be considered to ensure a viable and competitive seed business. Advise in detail **(14 marks)**

b) Differentiate between a single and a double maize hybrid cross. Give one advantage and disadvantage of each type of hybrid **(6 marks)**

Question 6

a) Explain the three types of seed storage **(9 marks)**

b) Differentiate between truth in labeling and minimum certification standards **(6 marks)**

c) Define "Seed Grading" and list any three advantages **(5 marks)**

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF PLANT SCIENCE
Fifth Year Examinations for Bachelor of Agricultural Sciences
AGC 572 POST HARVEST TECHNOLOGY
Final Examination, 2013/2014 Academic Year

Date: 18th July 2014 **Time: 9:00 – 12:00 hrs** **Venue: OMNIA 2**

Instructions: Answer all Questions.
Marks are as indicated.
Answer each section in a separate booklet.

SECTION A

1. Explain with examples physiological and compositional changes in horticultural products associated with post harvest losses. **(20 marks)**
2. Describe the Tomato value chain with particular emphasis on production and wholesale systems. **(20 marks)**

SECTION B

1 a. Describe and illustrate the manufacturing process of mango jam using a flow diagram. **(12 marks)**

b. Explain the principle of osmotic dehydration and give at least one limitation and advantage of this method. **(4 marks)**

c. Potatoes are peeled using the chemical peeling method and develop a brown colour after the peeling process. Explain the possible causes of this problem and offer the possible solutions. **(4 marks)**

SECTION C

1. You have been employed by York Farm as a Manager in the Rose Section (Production and Packinghouse). How would you handle Roses from harvesting until the start of packing house operations? **(20 marks)**

2 a. Discuss the factors that affect the storage life of horticultural products. **(10 marks)**

b. You have been requested to give a presentation on Botrytis Rot of Citrus to students at the Zambia College of Agriculture in Monze. Prepare a draft of your presentation. **(10 marks)**

End of Examination

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
2013/14 MID-TERM EXAMINATIONS

AGE 2111: FUNDAMENTALS OF MICRO-ECONOMICS

TIME	:	**THREE (3) HOURS**
ANSWER	:	**ALL QUESTIONS FROM SECTIONS A AND B**
MARKS	:	**AS INDICATED BELOW**

SECTION A

ANSWER ALL QUESTIONS
(Multiple choices-Each question carries 1 mark)
***Tick* or *circle* the correct answer**

1. Opportunity cost indicates:
   a) How much of each commodity is produced
   b) The sacrifice of one commodity required to produce one more unit of another
   c) Production costs
   d) The upward slope of the production possibilities frontier(PPF) or
   e) Both (b) and (d)

2. Which of the following would be the best definition of economics?
   a) A study of how to organise a planned economy
   b) A study to find the best possible method to help the poor
   c) An inquiry into why resources are scarce
   d) A study of the allocation of scarce resources among alternative uses
   e) An in-depth study of wealth distribution in the world

3. If an increase in the price of good X causes the quantity demanded of good Y to decrease, the two goods are:
   a) Normal goods
   b) Inferior goods
   c) Substitutes
   d) Complements
   e) Not related

4. If the sale of additional units results in more total revenue to the sellers and if there is no reason to think the demand curve has shifted, demand must be:
    a) Upward sloping
    b) Perfectly elastic
    c) Elastic
    d) Inelastic
    e) Perfectly inelastic

5. The principal of diminishing marginal utility implies that:
    a) The total satisfaction from all units of a good must decline as more of a good is consumed
    b) The rich are not as happy as the poor
    c) The extra satisfaction from consuming an additional unit of a good must eventually decline as the rate of consumption increases
    d) Choices (a) and (c)
    e) All of the above

6. The income effect works in the same way as the substitution effect whenever:
    a) Prices rise
    b) Prices fall
    c) The good whose price has changed regardless of which direction is a normal good
    d) The good whose price has changed, regardless of which direction is an inferior good

7. The curve showing the different combinations of two goods that can be produced with a given amount of money is called a:
    a) Demand curve
    b) Supply curve
    c) Indifference curve
    d) Budget line
    e) Marginal utility curve.

8. Which of the following is not a characteristic of indifference curves?
    a) They get flatter when you move down to the right
    b) They have negative slopes
    c) They usually cross
    d) They show the trade-offs a consumer is willing to make

9. Whenever there is an increase in output in the short-run, there will be an increase in:
    a) Marginal cost
    b) Average fixed cost
    c) Average variable cost

d) Total fixed cost
e) Total variable cost

10. Marginal cost cuts average total cost where average total cost is at its:
    a) Maximum
    b) Minimum
    c) Equilibrium
    d) None of above

11. Increasing long-run average cost is a result of:
    a) The law of diminishing returns
    b) Diseconomies of scale
    c) Constant returns to scale
    d) Economies of scale
    e) Decreasing costs

12. At breakeven point
    a) Marginal cost equals price
    b) Average variable cost equals price
    c) Average total cost equals price
    d) The firm is in equilibrium

13. A perfectly competitive firm maximizes profit in the short-run by operating where:
    a) Marginal cost equals average variable cost
    b) Marginal cost equals average cost
    c) Marginal cost equals price
    d) Marginal cost equals marginal revenue
    e) Choices (c) and (d)

14. The characteristics of a competitive industry include all of the following except:
    a) Easy entry and exit
    b) Many buyers and sellers
    c) Each buyer and seller is small relative to the market
    d) Buyers and sellers are ignorant
    e) Product is homogeneous

15. A monopolist can always increase revenue by:
    a) Lowering price, if demand is elastic
    b) Lowering price, if demand is inelastic
    c) Raising price, regardless of the elasticity
    d) None of the above

16. A cartel tries to raise industry profits by:
    a) Increasing price and quantity sold

b) Cutting price to increase the quantity sold
c) Restricting output in order to raise price

17. Cartels find it difficult to keep profits above average because:
    a) It is hard to keep other firms from entering
    b) Each firm in the cartel has an incentive to cheat by expanding output
    c) Each firm in the industry has an incentive to set its own price higher than the cartel price
    d) Choices (a) and (b)
    e) Choices (a) and (c)

18. What is happening to the total variable cost when the law of diminishing returns begins to operate?
    a) It falls at an increasing rate
    b) It falls at a decreasing rate
    c) It rises at a decreasing rate
    d) It rises at an increasing rate

19. If the employment of a factor is increased by one unit and all other factors are held constant, the change in physical output is called:
    a) Total product
    b) Marginal physical product
    c) Marginal revenue product
    d) Marginal cost

20. Monopolistic competition is best described as a market structure where:
    a) The firms are price takers
    b) There are barriers to entry and exit
    c) The firms produce differentiated products
    d) Most of the firms make super normal profits in the long-run.

SECTION B

INSTRUCTIONS: ANSWER ALL QUESTIONS

1. Suppose that the demand and supply functions for maize for the year 2000 are given as follows:

$$Q_D = 3550 - 266P$$
$$Q_S = 1800 + 240P$$

   a) Calculate the market-clearing quantity and price. ***(5 marks)***

   b) Calculate the own-price elasticity of demand at this price and quantity. ***(5 marks)***

   c) What is the price elasticity of supply at this price and quantity? ***(5 marks)***

   d) Suppose that a drought caused the supply curve to shift to the left such that the price rose to K4 per meda. Calculate the elasticity of demand at this new price. ***(5 marks)***

2. Mutinta has K100 to spend, and she can buy shoes and t-shirts. The price of a pair of shoes is K50, and the price of a t-shirt is K20

   a) Draw the budget constraint.***(5 marks)***

   b) What happens if prices and Mutinta's income grow by 20%? ***(5 marks)***

   c) What do you understand by transitivity of preferences? ***(5 marks)***

   d) Explain why two indifference curves cannot intersect each other. ***(5 marks)***

3. Use the information given below to answer the questions that follow

Output	Total cost	Total revenue	Price	Average revenue	Marginal revenue	Marginal cost	Total profit
0	30	0					
1	45	25					
2	65	50					
3	90	75					
4	120	100					
5	155	125					

   a) Calculate the average revenue, marginal revenue, price, marginal cost and total profit. ***(4 marks)***

b) What is the short-run loss-minimizing level of output? ***(4 marks)***

c) Why must price cover AVC if firms are to continue to operate? ***(4 marks)***

d) If the firm is covering its AVC but not all its fixed costs, will it continue to operate in the short run? Why or why not? ***(4 marks)***

e) What kind of market structure is represented by the above? ***(4 marks)***

4. a) Pure monopoly is a market structure characterized by one seller of a unique product that does not have close substitutes. With the aid of a diagram show the profit maximizing price and output of a monopoly. ***(4 marks)***

b) Show as clearly as possible using a diagram the income and substitution and total effects of a normal good. ***(5 marks)***

c) The kinked demand curve describes price rigidity. Explain how the model works. Why does price rigidity arise in oligopolistic markets? ***(5 marks)***

d) Monopoly markets are undesirable relative to perfectly competitive markets." Discuss. ***(6 marks)***

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS

2013 EXAMINATIONS

AGE 2122: FUNDAMENTALS OF MACRO-ECONOMICS

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS IN SECTIONS A AND B

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 – (each question carries 1 mark)

1. An example of a flow variable is:
   (a) An individual's monthly salary
   (b) A person's net worth
   (c) The value of a house
   (d) The number of cars owned on July 1, 2014
   (e) The percentage of the population that is male.

2. An example of a stock variable is:
   (a) A person's monthly salary
   (b) The price of a car
   (c) A baseball player's hits per season
   (d) The number of swallows that return to the southern hemisphere in November
   (e) The number of cars that are imported into Zambia per week

3. The measure of the fraction of the change in consumption caused by a change in disposable income is called the:
   (a) Marginal propensity to save
   (b) Marginal propensity to consume
   (c) Average propensity to save
   (d) Average propensity to consume
   (e) General functional relation

4. The value of marginal propensity to save is usually: mpc + mps
   (a) Constant and greater than 1
   (b) Constant and less than 0
   (c) Constant, greater than 0,and less than 1
   (d) Variable, but usually equal to 1
   (e) Always equal to either 0 or 1

5. If C = 50 + 0.5Y and I = 25 equilibrium income must be:
   (a) 100
   (b) 150
   (c) 75
   (d) 175
   (e) 124

6. Equilibrium income requires that:
   (a) S = I + G
   (b) S + I = G
   (c) S + G =I
   (d) G = I
   (e) S = G

7. With both government purchases and taxes in the Keynesian model, equilibrium income occurs where: STm = Iax
   (a) S = T + I + G
   (b) S + G = I + T
   (c) S = T + G
   (d) S + T = I + G
   (e) S + I = G

8. Including the foreign sector causes equilibrium income to occur where:
   (a) S + T + M = I + G + X
   (b) S + T + (S – M) = I + S
   (c) S + X – M = I + G + T
   (d) S + G + T = I + (M – X)
   (e) S + T = I + G + X – M

9. Commercial banks create money by:
   (a) Printing it
   (b) Borrow it
   (c) Lending excess reserves

(d) Accepting new chequing accounts
(e) Holding 100% reserves

10. Equilibrium income in the 1S – LM model is determined:
    (a) In the product market
    (b) In the money market
    (c) Simultaneously with the interest rate
    (d) Independently of the interest rate
    (e) Simultaneously with the price level

11. Frictional unemployment is a result of:
    (a) Workers not being trained for jobs that are open
    (b) Technological change
    (c) Recession
    (d) Minimum wages
    (e) Workers leaving jobs to search for better ones

12. The principal cause of cost-push inflation is:
    (a) Declining foreign trade balances
    (b) The money illusion
    (c) Rising price levels
    (d) Increasing unemployment
    (e) Market imperfections

13. When the Central Bank raises the discount rate:
    (a) Banks will not borrow from the Central Bank
    (b) Banks may have to call in loans to meet reserve requirements
    (c) Banks will feel an inflow of funds
    (d) Stock buyers will have lower down payments for stock purchase
    (e) Expectations of tight money in the future will probably be generated.

14. A deficit budget is:
    (a) Always contractionary
    (b) Always expansionary
    (c) Expansionary if the budget was in balance the preceding year
    (d) Expansionary if the budget was not in balance the preceding year
    (e) Contractionary if the budget was in balance the preceding year.

15. Compared with monetary policy, fiscal policy has:
    (a) A greater recognition lag

(b) A smaller lag associated with choosing a policy
(c) The same lag in implementing a policy
(d) The same lag in affecting the economy
(e) A similar problem of a long and variable lag

16. Which is the true statement:
(a) The marginal propensity to consume frequently has a negative value
(b) If consumption is K70 when disposable income is K100, the MPC = 7
(c) If consumption is K60 when disposable income is K100 and it is K67 when disposable income is K110 then the MPC = .7
(d) All of the above are false

17. If the required reserve ratio was 20%, and bank reserves were increased by K100, then money supply would:
(a) Increase by as much as K20
(b) Increase by as much as K100
(c) Increase by as much as K500
(d) None of the above

18. If the opportunity cost of maize in terms of wheat is higher in Zambia than in Zimbabwe, then:
(a) Zambia should export wheat
(b) Zambia should export maize
(c) We cannot tell because we do not know anything about comparative advantage.

19. An increase in expected inflation causes:
(a) The Phillips curve to shift up
(b) The Phillips curve to shift down
(c) The Phillips curve to become vertical
(d) No change in the Phillips curve

20. If a contractionary gap exists a proper fiscal policy would be:
(a) Decrease lump sum taxes
(b) Increase transfer payments
(c) Make a balanced government budget go into deficit
(d) All of the above
(e) None of the above.

SECTION B:

INSTRUCTIONS: ***ANSWER ALL QUESTIONS FROM THIS SECTION***
EACH QUESTION CARRIES 20 MARKS

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1. Given the following economic system:
   - $Y = C + I + G + X - M$
   - $C = 200 + .75Yd$ (Consumption function)
   - $T = 50 + .2Y$ (Tax function)
   - $G = 200$ (Government expenditure)
   - $I = 60 - 50i$ (Investment function)
   - $X = 100$ (Exports)
   - $M = 20 + .5Y$ (Imports)
   - $Yf = 640$ (Full employment output)

   (a) Derive the equilibrium equation for Y? ***(4 marks)***
   (b) If i = .20, what is the value of Y. ***(4 marks)***
   (c) What is the value of taxes? ***(4 marks)***
   (d) What is the state of government budget? ***(4 marks)***
   (e) Is the government pursuing an expansionary, contractionary or passive policy? Explain. ***(4 marks)***

2. (a) Given the data shown below, and assuming that all unlisted items are zero:

Capital consumption allowance	K 30
Exports	100
Gross private domestic Investment	100
Personal consumption	400
Wages, salaries and supplements	350
Business transfers	20
Government expenditures	150
Government transfer payments	35
Imports	50
Indirect business taxes	120
Corporate profits	100
Dividends	25
Personal income taxes	80

C+I+G+X-MP

   (i) Calculate the GNP using the expenditure approach. ***(5 marks)***

   (ii) Calculate NNP. ***(2 marks)***

   (b) Explain what double counting is. How is it avoided in the calculation of GNP? ***(5 marks)***

(c) Given: P = 100 + 5Y (Aggregate supply)
P = 240 – 2Y (Aggregate demand)
(i) Find equilibrium P and Y? ***(3 marks)***
(ii) Is there a liquidity trap? Explain. ***(5 marks)***

3. (a) Zambia and Zimbabwe each produce maize and cotton as shown below:

YIELD PER HECTARE OF MAIZE AND COTTON		
Crop	Zambia	Zimbabwe
Maize	6 tons	1 ton
Cotton	6 bales	3 bales

(i) Which country has an absolute advantage in the production of maize? Cotton? ***(4 marks)***
(ii) Which country has a comparative advantage in the production of maize? Cotton? ***(4 marks)***

(b) What fiscal policies are required to eliminate a contractionary gap? Explain the effects of each policy change. ***(8 marks)***

(c) You are given this account for a bank:

Assets			Liabilities
Reserves	K500	K3500	Deposits
Loans 3000			

The required reserve ratio is 10 percent.
(i) How much is the bank required to hold as reserves given its deposits of K3500? ***(2 marks)***
(ii) How much are its excess reserves? ***(2 marks)***

4. Explain the meaning of the following terms:
(a) Contractionary monetary policy
(b) Liquidity trap
(c) Intermediate goods
(d) Theory of comparative advantage
(e) Recession

END OF EXAMINATION

The University of Zambia
School of Agricultural Sciences
University First Half Examinations – March 2014

AGE 3381
Research methodology

Time: Three (3) hours
Instructions: There are four questions in this exam. Answer all questions.

1. For each of the following, state what it is and its role in the research process **{15 points}**
   a) Problem definition [3 points]
   b) Objectives [3 points]
   c) Literature review [3 points]
   d) Conceptual framework [3 points]
   e) Methods and procedures [3 points]

2. Conventional farming practices that involve full cultivation and removal and burning of residues have come under increasing criticism in recent years due to the adverse effects they have on the soil and sustainability. The Ministry of Agriculture and Livestock (MAL) would like to examine the possibility of promoting alternative agricultural practices, such as conservation farming. However, MAL needs to know the economic viability of such alternative practices and have asked you to prepare a proposal for a study along these lines. Answer the following as briefly as possible. **{15 points}**
   a) Why do you think MAL would be interested in a proposal as opposed to commissioning the study without the proposal? [5 points]
   b) Why is it important to maintain a one-to-one matching of ideas and focus across the different components of the research proposal? [5 points]
   c) Why is objectivity important as you prepare the research proposal? [5 points]

3. Research is defined as "a systematic approach to obtaining new & reliable *Knowledge*" (Ethridge, 1995). Answer the following questions about research. **{15 points}**
   a) Why do agricultural economics students have to learn research methodology? [4 points]
   b) "A worthwhile science has internal validity and external worth." (Gebremedhin and Tweeten, 1991). What do you think the authors meant? [3 points]
   c) Scientific research relies on science and science relies on research. Define science and research and explain why neither can function without the other. [4 points]
   a) Define normative and positive techniques used by agricultural economists to answer empirical questions. Give one example of each. [4 points]

4. In research, we find ourselves flitting back and forth between the theory realm and the observation realm and logic is one of the tools used extensively. **{15 points}**
   a) Define logic. [2 points]
   b) Distinguish between deductive and inductive logic and explain how each is used in the research process. Why do we need both in research? [5 points]
   c) What is a logical fallacy? List four examples of logical fallacies. [6 points]
   d) What would you do if your facts do not agree with theory? [2 points]

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

Final examination 2013/14 academic year

Course: AGE 4142 Agricultural Marketing and Pricing

Date: 24th July, 2014

Venue: Upper Dining Hall

Duration: 3 hours

Total Marks: 100

Instructions

Answer **all** the questions in Section A **and one** question in section B.

Section A

1. What is an agricultural market? **(4 marks)**

2. A firm is contemplating changing the price of its product to increase its revenue. As an expert in marketing and pricing, what price change would you recommend to ensure revenue increases? **(6 marks)**

3. Discuss price and output determination for storable agricultural commodities under purely competitive market structures. **(8 marks)**

4. Structure conduct performance theory is a model used to link elements of market structure to business conduct and performance in industrial economics. With the aid of examples, briefly explain how the performance of an industry can alter the industry's market structure. **(8 marks)**

5. Briefly explain three (3) aspects that would motivate farmers to form a cooperative. **(6 marks)**

6. Suppose the Ministry of Agriculture is exploring the possibility of introducing a grading scheme for soybeans in Zambia,

   a. Briefly explain the important characteristics of an economically significant grading scheme; **(4 marks)**

   b. What are the potential benefits of having a grading scheme for an agricultural commodity? **(6 marks)**

7.

   a. With the aid of illustrations, explain the concept of a market boundary. **(10 marks)**

   b. What causes shifts in market boundaries? **(4 marks)**

8.

   a. Explain three (3) types of price transmission and why each one occurs. **(9 marks)**

   b. Given the following price information for maize,

Month/year	Lilongwe (USD/ton)	Lusaka (USD/ton)
August 2012	120	189
August 2013	263	299

   Calculate and interpret the elasticity of price transmission for maize between Lilongwe and Lusaka. **(5 marks)**

9. Seasonal variations in prices are observed frequently when conducting empirical price analyses.

   a. What are the causes of seasonal variations in prices of agricultural commodities? **(4 marks)**

   b. Why is it important to understand the patterns of movements in time series price information? Give two (2) reasons. **(4 marks)**

   c. What does a maize seasonal price index of 1.235 for the month of January imply? **(2 marks)**

Section B

Answer Either:

10. Given that:
    - Proportion of expenditure on bread and cornflakes is 6 percent and 12 percent respectively,
    - own price elasticity of bread is -1.21
    - A 3 percent increase in the price of bread increases quantity of cornflakes demanded by 30 percent
    - A one percent increase in the price of cornflakes reduces the price of bread by 50 percent
    - consumer's expenditure on bread and cornflakes is a small fraction of total income earned,
    - income elasticities of bread and cornflakes are equal.

    Estimate the total elasticity of bread. **(20 marks)**

OR

11. Suppose the following equations represent demand and supply for milk in two regions of Zambia;

    Region A: Demand: $Q = 30 - 2P$

    Supply: $Q = 15 + 3P$

    Region B: Demand: $Q = 90 - 8P$

    Supply: $Q = 30 + 2P$

    Where Q and P represent quantity in liters and price in Zambian Kwacha respectively, for each region.

    a) What would be the market clearing price and quantities in each region if there is **NO** trade between the two regions? **(8 marks)**

b) If transfer costs are equal to K2 per liter of milk, will trade occur between the two regions? Explain your answer. **(2 marks)**

c) Determine the price at which the regions will trade and volume of trade assuming there are **no transfer costs. (10 marks)**

----------The End----------

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION EDUCATION

2013/2014 MID-ACADEMIC YEAR EXAMINATIONS

AGE 4211: INTRODUCTION TO AGRIBUSINESS MANAGEMENT

DURATION: 3HRS **DATE: 03/03/2014**

INSTRUCTIONS: ANSWER FIVE QUESTIONS. SECTION A IS COMPULSORY. ANSWER FOUR (4) OUT OF THE FIVE (5) QUESTIONS IN SECTION B

SECTION A COMPULSORY QUESTION

QUESTIONS	**MARKS**
1. Ikomazi Ltd is an agribusiness involved in the manufacture of agricultural equipment and machinery. The company has been given an order to produce 2500 valve castings per month. The fixed costs for the entire operation have been estimated to be K10, 000,000 and the variable costs to be K 15,000 per casting. The company intends to sell the castings at K 20,000 each.	
a. Determine the break-even point for the production of this order.	[5]
b. What level of profit could be made from this order?	[5]
c. By investing in new technology, the scrap rate could be reduced to a reliable level of 2%. However the new technology would increase the fixed costs to K15, 000,000 but reduce the variable costs to K 12,000 per casting. Would this investment be worth undertaking? Explain your answer in the context of the profit the agribusiness would make.	[10]
2. Ikomazi Ltd has been requested by its shareholders to expand its business and consider opening its own retail outlets. The company will have to compute, Solvency, Liquidity and Profitability ratios to determine whether they should consider borrowing or not.	
a. Explain what these ratios are and why they are important.	[6]
Using the Ikomazi Ltd financial statements on page 2;	
b. Compute the Debt to Equity ratio for 2012 and 2011.	[2]
c. Interpret these ratios and explain what the ratios tell you about the firms' solvency status.	[4]
d. Compute the Return on Sales (ROS) for 2012 and 2011.	[2]
e. Interpret the ROS for both years and explain what the ratios say about the firms' profitability level.	[4]
f. As General Manager of Ikomazi Ltd, would you encourage the proposal to expand the business?	[2]
Total marks	**40**

IKOMA21 ~~CLOVER~~ CORPORATION Income Statements For the Years Ended December 31, 2012 and 2011	2012	2011
Net sales	$ 494,000	$ 450,000
Cost of goods sold	(140,000)	127,000
Gross margin	354,000	323,000
Operating expenses	(270,000)	249,000
Net operating income	84,000	74,000
Interest expense (cost of borrowing)	(27,300)	8,000
Net income before taxes	56,700	66,000
Less income taxes (30%)	(23,010)	19,800
Net income	$ 33,690	$ 46,200

IKOMA21 ~~CLOVER~~ CORPORATION Balance Sheets December 31, 2012 and 2011	2012	2011
Liabilities and Stockholders' Equity		
Current liabilities:		
Accounts payable	$ 67,000	$ 44,000
Notes payable	30,000	6,000
Total current liabilities	**97,000**	**50,000**
Long-term liabilities:		
Bonds payable, 8%	75,000	80,000
Total liabilities	**172,000**	**130,000**
Stockholders' equity:		
Preferred stock	20,000	20,000
Common stock	60,000	60,000
Additional paid-in capital	10,000	10,000
Total paid-in capital	90,000	90,000
Retained earnings	80,000	69,700
Total stockholders' equity	**170,000**	**159,700**
Total liabilities and stockholders' equity	**$ 342,000**	**$ 289,700**

SECTION B: ANSWER FOUR QUESTIONS

QUESTION ONE

a. Outline and elaborate Maslow's hierarchy of needs [5]
b. What is the relevance of Maslow's hierarchy of needs to management [2]
c. What are the assumptions of theory X and Y? [6]
d. Based on theory X and theory Y, what kind of supervisor would you assign to an individual who is classified in either category? [2]

Total marks [15]

QUESTION TWO

Many agribusinesses often form strategic alliances with other business entities. In most cases the advantages of strategic alliances outweigh the disadvantages. Some examples of strategic alliances are Outgrower Schemes, Joint Ventures, Consortiums and Collective Action.

a. What is a Strategic Alliance? Discuss what a Strategic Alliances is as a business form highlighting what they are and how they are different from other business forms. [6]
b. When is it necessary or appropriate to form a Strategic Alliance? [3]
c. What is an Outgrower Scheme? [3]
d. What is a Consortium? [3]

Total marks [15]

QUESTION THREE

a. What is a Cooperative? [4]
b. What are the seven International Cooperative Alliance principles that cooperatives are supposed to adopt? Highlight and give details of each principle. [11]

Total marks [15]

QUESTION FOUR

Some of the key functions of Human Resource Management include Staffing, and Designing and Administering of Reward Systems.
Staffing will among other things involve conducting a Job analysis while Designing and Administering of Reward System will involve setting terms of compensation and benefits.

a. What is a job analysis? [2.5]
b. What are the **two** approaches that could be used to carry out a job analysis? Elaborate on these two approaches. [5]
c. Salaries, Fringe Benefits and Bonuses are some examples of rewards given to employees. Clearly explain what each of them is. [3x2.5]

Total marks [15]

QUESTION FIVE

Management practice requires that Managers make decisions about their day to day activities and the general running of a business. They are therefore constantly engaged in making decisions.

a. Define and explain what Decision Making is? [5]
b. Break Even Analysis is one of the tools that could be used in making decisions and it involves analyzing profit, costs and prices. Fully explain and illustrate Break Even Analysis. [5]
c. What is the Margin of Safety? Considering the risks involved in running a business, what is the decision criteria one would use with regards to the magnitude of the Margin of Safety? [5]

Total marks [15]

The University of Zambia.
School of Agricultural Sciences
2013/14 - Academic Year
Final Examinations

AGE 4222: Intermediate Agribusiness management

Instructions: *Answer all the five (5) questions. Each question's marks are indicated. Write legibly to avoid loss of marks. Start each question on a different (new) page. Failure to follow Instructions will attract loss of marks.*

Duration: ***3 hours.***

Qn.1]

a) Define who an entrepreneur is. [2 marks]

b) Explain thoroughly what role entrepreneurship plays in the economic development of a country

[14 marks]

2] Clearly explain and show what the BCG – growth share matrix is and at each Strategic Business Unit (SBU) give one strategy that can be used given the conditions existing. [14 marks]

3] a) Define supply chain management [2 Marks]

b) Thoroughly differentiate between vertical coordination and vertical integration of the supply chain management [9 marks]

c) Give six (6) benefits of the supply chain management [6 marks]

4] a) Define what agricultural marketing system is [2 Marks]

b) Explain in a clear manner the three important functions the agricultural marketing system performs. [12 Marks]

5] a) Define what market segmentation is [2 marks]

b) Show and explain the five (5) target market patterns formed based on identified segments and products

[15 marks]

-THE END-

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

EXAMINATIONS FOR 2013/2014 ACADEMIC YEAR

AGE 4311: QUANTITATIVE METHODS IN AGRICULTURAL ECONOMICS

Instructions: Answer all questions in Section A; and any one of the two questions in Section B.

Time: Three (3) hours

Section A (60 points)

Answer all questions in this section.

1. A model is a set of restrictions on the joint distribution of variables. State any three reasons why economists construct models.
2. Define the following terms
    a) Probability distribution
    b) Probability density function
    c) Mini-max regret criterion
    d) Simulation
3. Mathematical programming (MP) models typically comprise an objective function, a set of constraints, choice variables, and parameters. Answer the following questions as concisely as possible.
    a) Algebraically define all categories of static MP.
    b) List and define the eight assumptions of linear programming (LP).
    c) Is the feed formulation model a linear programming (LP) model? Explain.
    d) Why does Euler's theorem hold in LP models? When are the Karush-Khun-Tucker conditions used in LP models?
4. Mvula Associates, a Lusaka-based business, has scarce resources of land, labor and capital, and would like to determine how to allocate these resources between two competing cropping enterprises – maize and sorghum. They have 20 hectares of land, 72 man-days of labor, and $300 of capital. Maize requires four man-days of labor and $5 (capital) per hectare. Sorghum requires two man-days of labor and $20 of capital per hectare. The company expects a gross margin of $80 per hectare for maize and $70 per hectare for wheat.
    a) Set up the following

        i) The primal model in algebraic and tableau formats.

        ii) The dual model in algebraic and tableau formats.

    b) Write out the syntax/code that you would use to solve the primal problem using the General Algebraic Modeling Systems (GAMS).

Section B (40 points)

Instructions: Answer any one question from this section.

There are two questions in this section (Questions 5 and 6). Answer any one of these two questions.

5. A farmer has 160 hectares of land and proposes to grow maize and tobacco. He has 65 man-days of December labor and 110 man-days of January labor available. He requires 0.5 man-days of December labor per hectare and no January labor for maize and needs 1 man-day of January labor for each hectare of tobacco. The net returns from each hectare of maize and tobacco are $80 and $40, respectively. The farmer seeks to maximize his total profits.
   a) Solve the problem using the simplex method.
   b) Determine the optimal values of the objective function, real activities, and slack activities.
   c) Specify the dual to the problem in a).
   d) What are the optimal values of the dual variables?
   e) Explain the economic interpretation of the dual variables?
   f) Consider the following density function;

$$f(x) = \frac{1}{9}x^2 \quad 0 \le x \le 1$$

      a) Evaluate the above probability density function (PDF) between 0 and 1.
      b) Find the expected value of the PDF assuming x lies between 0 and 4.

6. Suppose you have the following facts and would like to determine the least cost shipment pattern for wheat.

	Transportation cost ($/tonne)			Excess supply (tonnes)
Surplus provinces	Eastern	Lusaka	Southern	
Central	50	70	90	800
Luapula	70	50	60	600
Northern	60	80	120	200
Excess demand (tonnes)	100	400	500	
Selling price ($/tonne)	80	90	100	

   a) Write out the algebraic LP model that you would use to determine the profit maximizing shipment plan.
   b) How many (i) real activities and (ii) constraints does this model have?
   c) Write out the GAMS syntax that you would use to solve the problem.
   d) Assuming fixed charges of $300, $250 and $350 at Central, Luapula and Northern Provinces, respectively, write out the corresponding plant location model i) algebraically, and ii) as a GAMS program.
   e) Distinguish between a shadow price and reduced cost.
   f) The plant location model requires use of a binary model Yi.
      i.e. Yi = {1 if it's economical to locate a plant at source I and 0 otherwise}
         i. What LP assumptions doesn't this requirement violate?
         ii. Is the plant location model an LP model? If your answer is yes, explain. If your answer is no, what class (es) of MP model doesn't it fall under?

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

Happy holidays!

The University of Zambia
School of Agricultural Sciences
2013/2014 Academic Year Second Half
Final Examinations

AGE 4322: Applied Econometrics
Time: Three (3) Hours

Instructions: There are five questions in this exam. Answer all.

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1. Suppose X can take on discrete values {1, 2, 3, 4} with respective probabilities {0.2, 0.4, 0.1, 0.3}.

   a) Compute the expected value and variance of X. (8 points)

   b) Now compute the expected value and variance of Y = 1/X. (7 points)

2. Yields Y_1 and Y_2 in two plots next to each other have means of 6 and 7 metric tons per hectare (MT/ha), respectively, both have standard deviations of 2 MT/ha, and have a correlation coefficient of $\rho = 0.8$. That is, $\text{Corr}(Y_1, Y_2) = \rho = 0.8$. Compute

   a) The expected value of average yield, $(Y_1 + Y_2)/2$, across the two plots. (5 points)

   b) the variance of average yield, $(Y_1 + Y_2)/2$, across the two plots.

   Hint: $\rho = \dfrac{\text{Cov}(Y_1, Y_2)}{\sqrt{\text{Var}(Y_1)}\sqrt{\text{Var}(Y_2)}}$. (10 points)

3. For each of the following statements, i) state whether it is true (T) or false (F), and ii) explain your answer.

   a) Estimators are random variables. (2 points)

   b) An estimator with the lowest variance is always the most preferred. (2 points)

   c) When an estimator has large variance, then there MUST be an irrelevant variable. (2 points)

   d) If the variance of the distribution of an estimator decreases when the sample size is increased, then the estimator is becoming more efficient. (2 points)

   e) An asymptotically efficient estimator is more preferable than one that is BLUE. (2 points)

   f) Covariance is a good measure of the degree of association. (2 points)

   g) We are justified to assume that the random error term is normally distributed. (2 points)

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

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

where x_1 and x_2 are explanatory variables, and e is the error term.

a) Derived the parameter variance-covariance matrix. (5 points)

b) Test for the statistical significance of the slope coefficients, assuming $t_{crit} = 1.980$. Show your work. (14 points)

c) Construct the 95% confidence interval (CI) for x_1. (5 points)

d) Test for the statistical significance of x_1 using the CI approach. (6 points)

5. Suppose as part of your AGE 500 you set out to estimate a maize demand function with the liberalization dummy variable as the only explanatory variable. Your initial OLS results are:

$$\hat{Q}_t = \underset{(<0.0001)}{76.427} - \underset{(<0.0001)}{43.366}\, D,$$

where the values in parenthesis are p-values. You also discover that F statistic = 69.609, p-value < 0.0001; and the Durbin-Watson statistic, d = 1.024; R square = 0.795; Adjusted R square = 0.783; and the variables are defined as:

Q_t = Quantity of maize demanded in kg per capita

D_t = Liberalization dummy variable equal to 1 if the year (t) is after 1991 and zero otherwise

a) Do you think this demand model is adequately specified? Explain your answer. (5 points)

b) Based on the results (and regardless of your answer to a), did market liberalization have any statistically significant effect on maize demand? Show your steps. ($\alpha = 0.05$). (8 points)

c) Test for AR(1) autocorrelation, given that d_L=1.20 and d_U=1.60. (8 points)

d) Suppose given your concern about autocorrelation, you also run the following model using OLS.

$$\hat{Q}_t = \underset{(0.145)}{21.798} - \underset{(0.147)}{12.613}\, D_t - \underset{(0.645)}{4.588}\, D_{t-1} + \underset{(0.001)}{0.706}\, Q_{t-1},$$

where the values in the parenthesis are **p-values**. Other statistics from this model include Adjusted R^2=0.921; Durbin Watson statistic = 1.835; and F statistic = 58.266 (p-value < 0.0001). How would you use these estimates to correct for autocorrelation? (5 points)

THE UNIVERSITY OF ZAMBIA
UNIVERSITY MID-YEAR EXAMINATIONS FEBRUARY 2014

AGE 511
AGRICULTURAL ORGANIZATION AND ADMINISTRATION

INSTRUCTIONS: ANSWER QUESTION ONE WHICH IS COMPULSORY AND ANY OTHER THREE FOR A TOTAL OF FOUR QUESTIONS. EACH QUESTION IS WORTH 25%.

TIME: 3 HOURS

1. (a) Explain and elaborate what management is. Clearly identify and define the five (5) major management functions? Cite one appropriate example of a specific activity related to performing each of the functions you have identified.**[10 marks]**

(b) Briefly outline ten (10) roles which managers typically play. **[10 marks]**

(c) What are the three skill areas that managers should possess and apply? You should also briefly comment on the skill mixtures needed by managers at various levels of management. **[5 marks]**

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2. (a) Explain and elaborate Maslow's theory of human needs. **[10 marks]**

(b) As a Manager in an agribusiness firm, how would you apply Maslow's theory in motivating employees in the workplace? Cite relevant examples to illustrate your application. **[10 marks]**

(c) Discuss the similarities and differences between Abraham Maslow's theory of human needs and Clayton Alderfer's theory of Existence, Relatedness and Growth needs (ERG theory). **[5 marks]**

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3. (a) Managers in organizations are expected to have a reasonable degree of leadership ability. Explain what leadership is? Elaborate on the four (4) bases of authority in leadership. **[7 marks]**

(b) Comment and elaborate on the five (5) bases of leadership power as propounded by French and Raven. **[10 marks]**

(c) Based on the interactive functions of a leader, identify and briefly explain the four (4) leadership styles. **[8 marks]**

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4. (a) Explain what the control function is. Giving relevant examples, elaborate the importance of controlling and what is involved in carrying out the control function in management **[7 marks].**

(b) Explain what Orientation is. Elaborate on what is involved in this activity and its relevance in terms of the staffing function **[8 marks].**

(c) Discipline is an important management duty. Outline the principles you would practice in maintaining discipline among subordinates in ~~this~~ an extension organization **[10 marks].**

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5. Write brief notes explaining salient aspects of the following:

(a) Characteristics of a bureaucracy **[4 marks]**

(b) Unity of Command **[2 marks]**

(c) Delegation **[2 marks]**

(d) Line and Staff Authority **[2 marks]**

(e) Theory X and Theory Y **[2 marks]**

(f) Matrix Organization Structure **[4 marks]**

(g) Communication Process **[2 marks]**

(h) Employee Assistance Programmes (EAP) **[4 marks]**

(i) Performance Appraisal **[3 marks]**

END OF EXAMINATION

The University of Zambia

School of Agricultural Sciences

Department of Agricultural Economics and Extension

2013 Academic Year Mid-Year Final Examinations

AGE 531 International Agricultural Markets, Trade and Development

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Date: Friday, 7th March, 2014 – Afternoon session

Venue: Omnia 1

INSTRUCTIONS

Answer ALL the questions in Section A and Section B; and ONE (1) question in Section C

Section A (26 Marks)

1) Briefly explain Purchasing Power Parity as a theory of exchange rate determination.

(6 marks)

2) One of the central beliefs of mercantilism was the view that exports are good while imports are bad. Give four (4) arguments that opponents of mercantilism would use against this belief. **(8 marks)**

3) In the Hecksher-Ohlin model, the distributive effects of free trade are such that a country's relatively abundant factor gains from trade while the country's relatively scarce factor loses from trade. Show how this is true if the country is capital abundant.

(8 marks)

4) Briefly explain the concept of a twin-deficit identity. **(4 marks)**

Section B (44 Marks)

5) Consider two friends, Mwale a resident of Zambia and Muricho a resident of Kenya. Muricho is a fan of Zambian Music and decides to buy ten DVD compilations of the latest Zambia hits from Sounds Investments at Manda hill shopping centre at ZMK 300. Mwale prefers handmade slippers and gives Muricho KS1.71 to buy him a pair. Mwale is so impressed with the quality of the slippers that he also buys shares in a kenyan slipper manufacturing shop worth KS3.29. Suppose these are the only trade transactions, record the transactions in the balance of payments for Kenya showing all your working. Assume the exchange rate is ZMK60 per Kenyan Shilling (KS). **(16 marks)**

6) Suppose two large countries, Kenya and Ethiopia, trade with each other such that each country exports to and imports from the other. Both countries are faced with three distinct policy options: free trade, 10 percent import tariff and 20 percent Import tariff.

The matrix below presents the national welfare payoffs based on the policy options available.

(Kenya, Ethiopia)		Ethiopia		
		Free trade	**10% Tariff**	**20% Tariff**
Kenya	**Free Trade**	(100, 100)	(70, 120)	(40, 140)
	10% Tariff	(120, 70)	(90, 90)	(60, 110)
	20% Tariff	(140, 40)	(110, 60)	(80, 80)

a) Among the nine outcomes, which outcome would Kenya most prefer? **(2 marks)**

b) Among the nine outcomes, which outcome would Ethiopia most prefer? **(2 marks)**

c) Identify which cell(s) correspond(s) to a Nash (or non-cooperative) equilibrium. Justify your answer. **(8 marks)**

d) Which cell corresponds to the cooperative equilibrium? Justify your answer. **(8 marks)**

7) Supply of fertilizer on the Zambia market is made up of local production and imports from different parts of the world. While Zambia is able to produce some fertilizer locally, not all the inputs are available locally. Local production of a ZMK1, 000 worth of fertilizer requires ZMK500 worth of imported inputs which attract an import tariff of 10 percent. In order to encourage local production of fertilizers, the Zambian government imposes a tariff of 25 percent on all imported fertilizer.

Calculate the Effective rate of protection to the domestic fertilizer industry in Zambia. **(8 marks)**

Section C (20 Marks)

EITHER

8)

a) Compare and contrast Regionalism and Multilateralism as concepts in international trade. **(6 marks)**

b) "If free trade is economically the most efficient policy, it would seem to follow that any movement towards free trade should be beneficial in terms of economic efficiency".

Is this statement valid in the case of countries forming free trade areas? Please explain clearly with illustrations. **(14 marks)**

OR

9) A Voluntary Import Expansion (VIE) is implemented by an importing country to expand the flow of imports across borders. Suppose Zambia, a large country, implements a VIE to increase the flow of fertilizer from Malawi,

a) What happens to the domestic supply, price and import demand for fertilizer in Zambia? **(3 marks)**

b) What happens to the domestic supply, price and export supply in Malawi? **(3 marks)**

c) In most cases, a quantitative expansion using a VIE is unlikely to be workable, why? **(4 marks)**

d) What alternative policy can Zambia use to expand imports? Please show the welfare effects of such a policy. **(10 marks)**

----------THE END----------

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2013-2014 MID-YEAR FINAL EXAMINATIONS

AGE 541: AGRICULTURAL PROJECT PLANNING AND APPRAISAL

TIME: THREE HOURS

INSTRUCTIONS:

i) Answer all questions
ii) Leave the discount tables in the examination hall

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1. (a) "Projects are the cutting edge of development" (Gittinger). Explain how relevant this assertion is to Zambia's development plans. (4 marks)
b) What is a project cycle? Give a graphical description of its main stages. (6 marks)
c) Cost recovery is an important issue in the analysis of government receipts and expenditures on projects. Discuss three objectives of cost recovery and two measures calculated to help form judgments about cost recovery. (10 marks)

2. a) Why is choosing a discount rate important in project analysis? (4 marks)
b) Describe and explain briefly the discount rates that can be used in both financial and economic analysis. (10 marks)
c) Discuss and describe, with an illustration, the special case that involves the choice of technologies in which selection of one technology rules out its alternatives realizing the same result. (6 marks)

3 The following investment outlays, operation and maintenance costs (cash outflows) as well as gross benefits (cash inflows) are given for a phosphate production and processing project proposal.

Amounts in K'000				
Year	**Investment Outlay**	**Operation and maintenance**	**Production Cost**	**Gross Benefit**
1	450	0	0	0
2	350	0	0	0
3	300	0	0	0
4	200	0	0	0
5	200	0	0	0
6	0	40	50	890
7	0	50	60	1010
8	0	50	70	1120
9	0	50	80	1230
10	0	50	80	1230

a) Compute the Net Benefit-Investment (N/K) ratio if the opportunity cost of capital is 20%. On the basis of the N/K you obtain, would you recommend the project as good investment? Explain why? (6 marks)

b) Compute the Internal Rate of Return (IRR). On the basis of the IRR you obtain and given 20% as the opportunity cost of capital, would you recommend the project as good investment? Explain why? (10 marks)

c) In another project and at an opportunity cost of capital of 20%, a 30% reduction in the project's net benefits results in a positive net present value of K+50.00 whereas a 35% reduction in the project's net benefits results in a negative net present value of K-30.00. What is the magnitude (switching value) of the net benefits decrease before the project's net present value falls below an unacceptable level? Explain your answer. (4 marks)

4. The foreign exchange component and the domestic currency component of a bio-fuel production project are as given in the following table:

Year	Foreign Exchange Component (US$'000)			Domestic Currency Component (K'000)	
	Value of Production	Investment Cost	Production Cost	Investment Cost	Production Cost
1	0	200	0	450	0
2	0	250	0	400	0
3	0	250	0	350	0
4	250	0	250	150	150
5	850	0	350	0	300
6	900	0	400	0	300
7	900	0	400	0	300
8	900	0	400	0	300
9	900	0	400	0	300
10	900	0	400	0	300

a) If the opportunity cost of capital is 20%, compute the domestic resource cost (DRC). If the official exchange rate (OER) is K5.60 to US$1 and on the basis of the DRC you obtain, is the project favourable? Explain why? (10 marks)

b) If there is a foreign exchange premium of 20%, what is the shadow exchange rate (SER)? In the light of the SER you obtain and on the basis of the DRC you obtained in a) above, would you say the project is favourable? Explain why? (4 marks)

c) Why is it important to estimate the DRC and for what type of projects? (4 marks)

d) What are the limitations of the DRC as a tool of project analysis? (2 marks)

5. Write short notes on the following:
   a) Undiscounted versus Discounted Measures of Project Worth. (5 marks)
   b) "With" and "Without" versus "Before" and "After" Project Comparisons. (5 marks)
   c) Tangible versus Intangible Costs and Benefits in project analysis(5 marks)
   d) Secondary costs and benefits in project analysis. (5 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
Department of Agricultural Sciences

2013 FINAL EXAMINATIONS

AGE 562/ 5262 – INTERMEDIATE FARM MANAGEMENT

TIME: THREE HOURS

INSTRUCTIONS: *1.* **ANSWER** ***ANY FIVE QUESTIONS***
2. ALL QUESTIONS CARRY EQUAL MARKS

QUESTION 1

a) Discuss four characteristics of agricultural labour. How would each of these characteristics help a manager to improve labour utilization?
b) Compensation packages for employees will include a cash salary plus different bonuses and various incentives. Discuss six factors that affect compensation decision on many farm businesses.

QUESTION 2

Write short notes, giving examples, on the following:

a) a system
b) management information system
c) preliminary controls
d) concurrent controls
e) feed back controls

QUESTION 3

a) Discuss ways a manager can improve labour efficiency on a farm
b) Purchasing of a farm is an important decision, often involving large sums of money. The first step in the purchase decision would be to determine value of the land. Discuss factors that determine this value of land.

QUESTION 4

a. A farmer borrowed K1, 200 at 7% add-on interest to be repaid over a year with 12 monthly payments.

   i) What is the total interest charge on this loan?
   ii) What are the monthly payments on this loan?
   iii) What is the annual percentage rate of interest being charged?

with a boot Payment of K6000

b. The farmer also acquires a tractor which is finances by a dealer on a three year plan with equal payments of K2, 450 at the end of each year

   i) What is the interest charge on this loan?
   ii) What is the annual percentage rate being charged on the finance plan?

QUESTION 5

A farmer is considering replacing part of his worn out machinery and equipment. The total cost of this replacement is estimated to be K59, 000,000. He currently has K11, 000,000 that he could use for a down payment.

The income and expense information on the farmer shows that K10, 000,000 cash is available for debt servicing. Assume seven years repayment period t 14% interest on loan is agreed with the lending institution. Comment on the farmer's repayment capacity. What negotiations would have to be made in order to improve this capacity? (Show your suggestions based on calculations).

QUESTION 6

A number of factors influence interest rates that must be paid by farmers and ranchers? Discuss these factors, showing how they influence the interest rates.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2013/14 ACADEMIC YEAR
FINAL EXAMINATIONS

AGE 572: AGRICULTURAL POLICY ANALYSIS
TIME: THREE HOURS
INSTRUCTIONS: Answer all questions

1. a) Illustrate and explain by use of a Production Possibility Frontier diagram the implications of policy interventions regarding the following for a two commodity economy producing rice and wheat: (10 marks)
   i) Efficiency and inefficiency.
   ii) Attainable and unattainable.
   iii) Possible shifts (changes) in the production combination of the two commodities.

   b) The demand and supply are the two sides of the market and prices are the signaling device that links the two together. For a commodity like maize and assuming conditions of perfect competition, explain by use of a diagram: (10 marks)
   i) The range of possibilities that the supply and demand curves together solve the allocation problem as the price of maize varies.
   ii) How the market solution will maintain the equilibrium if the price of maize is set either too low below or too high above the equilibrium price.

2. a) The conventional treatment of externalities begins from the proposition that the market is said to fail when there is a technological externality or a non-market spillover. Explain and illustrate by use of examples and a diagram the economics of this type of failure as well as the correction of the externality. (10 marks)

   b) The Bank of Zambia recently announced that the policy interest rate will be set at 12% per annum (i.e. as a base rate) and the Minister of Agriculture and Livestock also recently announced following the forecast maize pumper harvest for 2013/14 season the government will not restrict regional maize trade:

   i) Contrast the nature and type of these two policy instruments (4 marks)
   ii) Explain and discuss the implications of the implementation of the two policy interventions on the agriculture sector. (6 marks)

3. a) The PAM is computational framework for measuring input use efficiency in production, comparative advantage and the degree of government interventions. Describe briefly the steps to be followed in the construction of PAM. (10 marks)

b) Explain and discuss briefly the instances/situations when policy makers might use the PAM. (10 marks)

4. a) A suggested redefined pricing role of Food Reserve Agency (FRA) could be one of guaranteeing and defending producer price floors and consumer price ceilings in order to perform this function more effectively. Explain and illustrate by use of a diagram how such a new, limited market function of FRA would work. You may make appropriate assumptions in your explanation if appropriate. (14 marks)

b) What is pan-seasonal food crop pricing? What are the arguments which have been advanced in favour of a marketing agency using intra-seasonal price variation for food crops? (6 marks)

5. a) It has been argued that basic research is almost by definition a non-commercial activity since appropriability is expected to be low. Explain and illustrate by use of a diagram why this is so. (12 marks)

b) What are the main reasons that have been advanced for the private sector to under-invest in agricultural research and what are the other pertinent reasons that underpin public intervention in agricultural research? (8 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2013/2014 ACADEMIC YEAR - TERM III FINAL EXAMINATION
AGE 582: PROJECT MONITORING AND EVALUATION

TIME: THREE (3) HOURS
INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER FOUR FOR A TOTAL OF FIVE. EACH QUESTION IS WORTH 20%.

Question One

a) What is Mono-method Bias? With an example, explain in detail what it is, how it arises and how it is a problem in project Monitoring and Evaluation. Explain in detail how this problem of Mono-method bias can be resolved.
b) Using appropriate and consistent examples, what are project results?

Question Two

Explain what a Logical Framework is. Elaborate on the elements of a typical log frame and elucidate on the terms "vertical logic" and "horizontal logic".

Question Three

The Ministry of Community Development has engaged you as an Evaluation Consultant to carry out institutional assessments of five (5) CBO's in Muchinga Province and submit recommendations on each of them. You have further being requested to conduct a standardized assessment on each of these CBO's.
List and discuss the factors you would include in the institutional assessment.

Question Four

Write brief notes explaining the main aspects of the following:
(a) Project Stakeholders
(b) Intervening variables
(c) Criteria for effective Indicators for evaluation
(d) Social Analysis

Question Five

a) What is Participant Observation? Elaborate on its importance, advantages and disadvantages in data collection for Monitoring and Evaluation. You should also outline and explain the stages followed in conducting a study using a Participant Observation approach.
b) Identify four (4) other qualitative methods of data collection and briefly explain what they are.

Question Six

Explain the conceptual and methodological issues or problems associated with defining and measuring demographic data, income and employment in an impact evaluation.

End of Exam

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2013/14 MID-TERM EXAMINATIONS

AGE 5241 – PRINCIPLES OF FARM MANAGEMENT

TIME: THREE HOURS

INSTRUCTIONS: ***ANSWER ANY FIVE QUESTIONS***

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1. Identify the types of risk and uncertainty faced by farmers. Discuss the various safe guards' farmers and/or Governments use against these risk and uncertainty in the farming business. ***(20 marks)***

2. A. Carefully discuss the uses and advantages of the cash flow budget.
   B. Discuss the difference between the financial statement and the income statement. ***(20 marks)***

3. Mr. Chanda wishes to add 100 steers to his beef herd. He invests K6, 000 in additional buildings at an annual cost of 12% of the investment; and K2, 000 on additional equipment at an annual cost of 18% of the investment costs

   Revenue consists, steers sold at K374/head, but 40 tones of hay @ K30/ ton should be purchased to feed the additional 100 steers. Storage for this is available. Each steer is purchased at K216. Additional feed required is K70 maize and K15 supplement/ head.

   Present labor requirement for 100 steers is on average 10 hours / head. Labor cost is estimated at K2.50/head. Veterinary and medicine costs are K7/head. Included, interest for one steer is estimated at 16% of the purchase price. Mortality rate is estimated at 1% of the purchase price.

   If new labor requirements for 200 steers' average at 8 hours/ head. Is it a good idea for Mr. Chanda to make this investment to enable him change from 100 to 200 steers? Advise him. ***(20 marks)***

4. The following is a summary of Mr. Phiri's balance sheet for the last two years.

ASSETS		**DEC 31 2012**	**DEC 31 2013**
Current			
	Cash	65,000.00	-
	Inventory	15,000.00	74,000.00
	Total	***80,000.00***	***74,000.00***
Intermediate			
	Machinery	40,000.00	46,000.00
	Total	***40,000.00***	***46,000.00***
Fixed			
	Buildings	100,000.00	200,000.00
	Land	120,000.00	380,000.00
	Total	***220,000.00***	***580,000.00***
Total assets		**340,000.00**	**700,000.00**
LIABILITIES			
Current			
	Demand notes	60,000.00	200,000.00
	Operating loans	5,000.00	3,600.00
	Total	***65,000.00***	***203,600.00***
Intermediate			
	Breeding cow loan	6,000.00	-
	Total	6,000.00	-
Long term liabilities		39,000.00	256,400.00
	Total	***39,000.00***	***256,400.00***
Total liabilities		**110,000.00**	**460,000.00**
	Equity	**230,000.00**	**240,000.00**

Using this information evaluate and comment on the changes of this farm business using;

a. Measures of solvency i.e. net capital ratio, and the leverage ratio.

b. Measures of liquidity i.e., current ratio, and the working capital ratio.
(20 marks)

5. Use a graphical method for profit maximizing plan for linear programming.

		Resource requirements (per hectare)	
Resource	**Limit**	**Maize**	**Soybeans**
Land (hectares)	120	1	1
Labor (hrs)	500	5	3
Operating Capital (K)	15,000.00	100.00	80.00
Gross margin (K)		120.00	95.00

a. What is the most profitable level of these two products, maize and soybean to produce?

b. What level of gross margin does this combination of output give? ***(20 marks)***

6. A. Depreciation is the reduction in the market value of a machine or equipment; explain three (3) reasons that cause this loss in value.

B. A machine has a new cost of K10, 000. Its salvage value is estimated at K2, 000, and a useful life of 10 years is also estimated with a rate of 20%.

To estimate the value of this machine in the years given, calculate depreciation for the farmer to correctly estimate his tax payments using;

a. The Straight line depreciation

b. The sum – of – years' digits,
Comment briefly on which method is appropriate in the Zambian context.
(20 marks)

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/14 ACADEMIC YEAR MID - YEAR

FINAL EXAMINATION

AGF 2015: FUNDAMENTALS OF ORGANIC CHEMISTRY

TIME : THREE HOURS

INSTRUCTIONS:

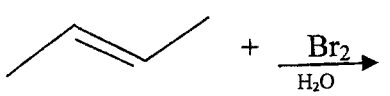
There is a Total of **Six (6) questions** in this paper. Answer any **five questions.**
All questions carry equal marks. Use illustrations in your answers where necessary.

1.

a) Draw structures corresponding to the following IUPAC names.
   I. 1-Ethyl-2-methylcyclopentane.
   II. 1- Bromo-3-ethyl-5-methylcyclohexane.
   III. Methylcyclopentane.

b) Rank the following in the order of priority; O, Br, N, Cl, C, H.

c) Draw the structure of propyne, **$CH_3C{\equiv}CH$**. Indicate the hybridization of each Carbon tom.

d) Propose the mechanism of reactions for the following reactions.
   I. $CH_4 + Cl_2 \rightarrow$
   II. 

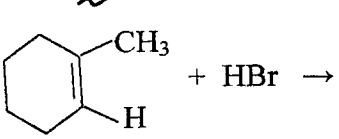
2.

a) Draw skeleton structures for the following organic compounds.
   I. 1, 3 dimethylcyclopenten.
   II. 4, 6 dimetyl-2-heptene.
   III. 2, 4 heptadiene.

b) Rank the following in the order of Carbocation Stability; R_3C+, CH_3+, RCH_2+, R_2CH+

c) Draw the structure of Ethyne, **C_2H_2.** Indicate the hybridization of each Carbon atom.

d) Show the mechanism of reaction for the following reactions;

   I. $(CH_3)_2C{=}CH_2 + HCl \rightarrow$
   II. 

3.

a) Draw skeleton structures for the following organic compounds.

I. 1-bromohex-3-yne.

II. 2, 5, 5- trimethylhept-3-yne.

III. Octa-2, 4-dien-6-yne.

b) State the number of double bonds and/or rings in these formulas.

I. Benzene C_6H_6

II. Cyclohexene C_6H_{10}

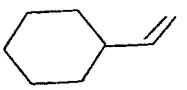
c) Determine the Names and Shapes of the following molecules.

I. CH_3CHO

II. CH_3OH

III. NH_3

d) Propose a mechanism to account for the formation of 1-bromo-1-ethylcyclohexane.



4.

a) Formaldehyde, CH_2O, contains a carbon – oxygen double bond. Draw and name the structure of Formaldehyde and indicate the hybridization of the Carbon atom?

b) Propose one simple structure for each of the following.

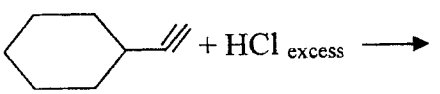
I. Aldehyde.

II. Ketone.

III. Carboxylic acid.

c) Propose structures of two isomers of formula C_2H_6O.

d) Propose a mechanism of reaction for the following reaction.



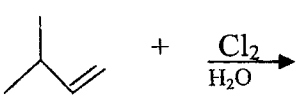
5.

a) List the Physical properties of alkenes and alkynes.

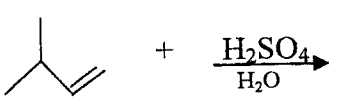
b) Draw the structure of Ethyne, C_2H_2. Indicate the hybridization of each Carbon atom.

c) Predict the major organic product or products for the following reactions.

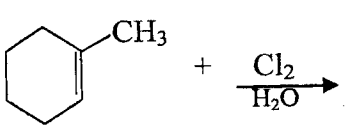
I.



II.



d) Propose a mechanism of reaction for the following reaction.



6.

a) Describe the geometry, hybridization, and bonding in Propyne, $HC{\equiv}CCH_3$, a molecule with three central atoms.

b) Draw structures corresponding to the following IUPAC names.

I. Hepta-3, 6-dien-1-yne.

II. 1, 3 Dimethylcyclopenten.

III. 4, 6 Dimetyl-2-heptene.

c) Use the VSEPR model to predict the shape and the bond angles for the following molecules.

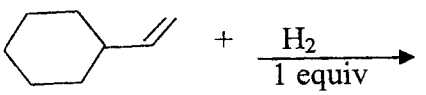
I. CH_3COOH

II. CH_3CN

III. $CH_3CH_2CONH_2$

d) Propose a mechanism of reaction for the following reaction.

I. $CH_3CH_2CH{=}CH_2 + Br_2 + I^- \longrightarrow$

II.  + $\xrightarrow[1\text{ equiv}]{H_2}$

END OF QUESTION PAPER

THE UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Food Science and Technology

INTRODUCTION TO INFORMATION TECHNOLOGY AND COMMUNICATION
AGF 2401

2013-2014 FINAL EXAM

Date: 28th FEBRUARY 2014
Venue: OMNIA 1
Time: 14:00hrs – 17:00hrs
Duration: 3 Hour

Instructions

1. This exam has three sections
2. Answer **all** questions in Sections A and B
3. Section C has four (4) questions. Chose **any** three (3)
4. Section A contains multiple choice question
5. Question B and C contains open ended questions

SECTION A [20 Marks]

Answer all questions in this section.

1. Company ABC wants to acquire software that can help them run their accounts department. The company wants it to be easy to make changes in the software. Which ways (s) of acquiring software would you recommend for them? [2]
   A. Buying off-the-shelf software
   B. Ordering customized software
   C. Developing customized software
   D. Downloading public domain software
2. How many devices can a USB in conjunction with a USB hub support? [2]
   A. 27
   B. 17
   C. 127
   D. 3
3. Mr. Phiri wants to have internet access at home. Where would you advice Mr. Phiri to go and get internet access for his home? [2]
   A. Local network
   B. Internet
   C. ISP
   D. World wide web (WWW)
4. Which rule below is not considered by Operating Systems on how files can be named? [2]
   A. Maximum number of characters
   B. Special Characters allowed
   C. File size
   D. Difference between upper and lower case letters
5. What type of Read Only Memory (ROM) can be erased using ultraviolet light? [2]
   A. ROM
   B. PROM
   C. EPROM
   D. EEPROM
6. What file extension is associated with Lotus 1-2-3 spreadsheet file? [2]
   A. .lsf
   B. .lotus
   C. .wk4
   D. .man

7. Ms. Mwansa broke the display of her laptop. As a computer expert, you want to replace this display. What type of display would you use to replace it with? [2]
    A. Cathode-ray tube display
    B. Digital light processing display
    C. Liquid crystal display
    D. None of the above
8. What type of Random Access Memory (RAM) is used for cache memory? [2]
    A. Dynamic Random Access memory
    B. Cache memory
    C. Static Random Access memory
    D. None of the above
9. UNZA has developed software that students can use to manage Microsoft excel program. A student can use this program to start excel program, stop excel program and manage all the documents excel program wants to print. Under what category can we group this software UNZA has developed? [2]
    A. System software
    B. Presentation software
    C. Application software
    D. Software manager
10. A Standard Ethernet cable can transmit up to how many bits in a second? [2]
    A. 20Mbps
    B. 15Mbps
    C. 10Mbps
    D. 10Gbps

SECTION B [20 Marks]

Answer all questions in this section.

1. Draw and explain the Logical system architecture of a computer. [4]

2. Word Processing software is software that we use to create, modify, store, retrieve and print all or part of document. List four (4) uses of a word processing software [4]

3. List two advantages of using word processing software. [2]

4. The computer has changed society today as much as the industrial revolution changed society in the eighteenth and nineteenth centuries. List and explain areas of society computers have changed. [8]

5. The internet is the largest network in the world that connects hundreds of thousands of individual networks all over the world. List two uses of the Internet. [2]

SECTION C [60 Marks]

Answer any three (3) questions. Each question carries 20 marks

1. Computers can be put in many categories. Computers can be categorized on many factors, namely; in terms of their use, or in terms of their size just to mention but a few.
   a) Explain what Server computers are [4]
   b) Explain what Mainframe computers are [4]
   c) Explain what super computers are [4]
   d) Explain what Embedded computers are [4]
   e) Explain what mobile computers are [4]

2. An electronic spreadsheet is analogous to an accountant's ledger sheet. It contains rows and columns for entering character or numeric data.
   a) List and explain five (5) uses of spreadsheet software [5]
   b) List and explain five(5) terminology used in spreadsheet software [5]
   c) List and explain five (5) advantages of using spreadsheet software [5]
   d) List and explain five (5) disadvantages of using spreadsheet software [5]

3. Every day, people around the world rely on different types of computers for a variety of applications. Computer users can be put in many categories.
   a) Explain who a computer home user is [4]
   b) Explain who a computer Small office/home office (SOHO) user is [4]
   c) Explain who a computer Mobile user is [4]
   d) Explain who a computer power user is [4]
   e) Explain who a computer enterprise user is [4] .

4. Presentation software is software that facilitates creation of a series of slides, i.e., a presentation.
   a) List and explain five(5) terminology used is presentation software [5]
   b) List and explain five (4) advantages of using presentation software [4]
   c) List and explain five (2) disadvantages of using presentation software [2]
   d) List four(4) examples of presentation software [4]
   e) List five (5) similarities between Microsoft word and Microsoft power point [5]

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/14 ACADEMIC YEAR MID - YEAR

FINAL EXAMINATION

AGF 3021: CHEMICAL TECHNIQUES IN FOOD ANALYSIS

TIME : THREE HOURS

INSTRUCTIONS:

There is a Total of **Six (6) questions** in this paper. Answer any **five questions.**
All questions carry equal marks. Use illustrations in your answers where necessary.

1.

a) Distinguish between Qualitative Analysis and Quantitative Analysis. Give an example for each term.

b) Chemical Analysis can be affected by at least two types of error. Explain in detail the following terms ;

- **I.** Indeterminate (Random) Error.
- **II.** Determinate (Systematic) Error.

c) Standard Deviation is a term that is widely used in statistics as a measure of precision. Express this term in terms of the number of degrees of freedom and in terms of its variance.

d) The following replicates of weighing were obtained: 29.8, 30.2, 28.6, and 29.7 mg. Calculate the standard deviation of the individual values and the standard deviation of the mean. Express these deviations as absolute (units of measurements) and relative (% of the measurements) values.

2.

a) Distinguish between Precision and Accuracy of analytical data.

b) Explain in detail the following terms;

- **I.** Standard Deviation.
- **II.** Variance.
- **III.** Relative Standard Deviation.

c) List three main sources of determinate errors and briefly discuss how each of these errors are caused.

d) A sample that was analyzed by a laboratory had the following results of the concentration of Fe; 19.4, 19.5, 19.6, 19.8, 20.1, 20.3 ppm. Calculate the Standard deviation, Variance, Relative standard deviation and the Coefficient of variation.

3.

a) Determinate Instrument errors are usually common in Chemical analysis. Discuss the methods used to correct these errors?
b) Describe the Characteristics of a good Calibration. Give an example.
c) Determine the mean and standard deviation for the following data; 9.982 ml, 9.986 ml, 9.982 ml, 9.981 ml, 9.990 ml.
d) Calculate the variance for the following Experimental Data; 19.4mg, 19.5 mg, 19.6 mg, 19.8 mg, 20.1 mg, 20.3 mg.

4.

a) Explain in detail the mechanism of operation for the following.
   I. Grab Sampling.
   II. Coning and Quartering.
b) What are the six basic principles of sampling from a Conveyor Belt?
c) Explain in detail the mechanism of operation for the following Sampling devices.
   I. Chute type Sample splitter.
   II. Rotary riffle splitter.
d) Explain in detail the mechanism of operation for each of the following methods for collecting samples.
   I. Linear Traversing Cut.
   II. Rotational Traversing Cut.
   III. Stationary Cut

5.

a) List the factors that affect Gross sampling for solids in fragments of varying size
b) List the advantages and disadvantages of Wet- Ashing and Dry- Ashing.
c) Explain in detail the following procedures.
   I. Sample storage.
   II. Sample drying.
d) Explain in detail the following terms.
   I. Retention time.
   II. Separation factor.
   III. Capacity factor.
   IV. Resolution - illustrate in terms of resolution between two peaks (R =0.5, 0.75, 1, 1.5)

6.

a) Explain in detail the basic principle of all Chromatographic techniques?
b) Classify the different types of chromatographic techniques and explain the mechanism of operation.
c) Compare Adsorption and Partition (Normal – Reverse Phase) Chromatography.
d) Calculate the adjusted retention time and the capacity factor given that Methane, Benzene and toluene elutes at 42s, 251s, 333s respectively. Assuming that methane is unretained. (Illustrate your answer by means of a Chromatogram and label the necessary information).

THE END

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/14 ACADEMIC YEAR MID-YEAR FINAL EXAMINATION

AGF 3031 – Food Chemistry (Practical)

Instructions:

This paper has a total of **three (3)** questions and you are required to answer **all** the questions. All marks allocated to each question are indicated at the end of each question.

Time allowed: **One and half Hours (1 hour 30 minutes)**

QUESTION 1

Imagine that you have just graduated and have been recruited by a food manufacturing company as a Quality Control Officer. The company manufactures different types of food products. The company would like to set up a new laboratory to be carrying out laboratory analyses on the proximate composition of the raw materials, intermediate and finished food products. The proximate composition analyses will involve analyzing moisture, crude protein, fat (oil) contents, crude fibre and ash. Your Managing Director (MD) tasks you to write a report on what is required to set up such a laboratory. **Excluding human resource and reagent requirements**, write a report on what is required to set up such a functioning laboratory, that is, in terms of infrastructure and laboratory equipment. Justify to your MD (who is not a scientist) why you are proposing the items you have outlined in your report. **(20 marks)**

QUESTION 2

With the help of chemical equations explain the basic steps of crude protein determination in a food sample. **(20 marks)**

QUESTION 3

Assume you were in-charge of a food chemistry laboratory. The laboratory is able to determine a number proximate properties. A Non-governmental Organization (NGO) has

brought to your laboratory a high energy protein supplement (HEPS) to determine the moisture, oil and ash contents.

(a) In order to determine the moisture content of the HEPS, you weighed a dry dish with its cover (27.5234g). To the weighed dish, you placed 2.0078g of HEPS in the dry dish. After loosening the cover, you placed the dish in an oven for 1 hour at 120°C. Thereafter, you removed the dish from the oven, tightened the cover quickly and cooled it in a desiccator for 1 hour. You weighed the dish with the cover again giving a weight of 29.3505g.

(i) Calculate the moisture content (in %) on wet basis (wb) **(3 marks)**

(ii) Calculate the moisture content (in %) on dry basis (db) **(2 marks)**

(b) In order to determine the oil content of the HEPS, you carefully ground and homogenized the HEPS. You gently mixed the HEPS prior to weighing the test portion. You weighed 5.0056g of HEPS and transferred the HEPS into the extraction thimble. You plugged lightly the mouth of the thimble with cotton wool. The oil was extracted with 250ml of petroleum ether for about 7 hours in a previously dried and weighed extraction flask, 27.1235g. After 7 hours of soxhlet extraction, you evaporated the solvent with a rotor evaporator. You then dried the extracted content at 60°C for 30 minutes and placed it in the dessicator to cool. After cooling for 1 hour, you weighed the extraction flask and its content, 27.6241g. The oil content was also determined on the same HEPS using a standard method. It was found that the fat content was 18.3% on dry basis.

(i) Calculate the oil content (%) in the HEPS **(3 marks)**

(ii) Calculate the oil content (in %) on dry basis (db) **(3 marks)**

(iii) Express the oil content on wet basis as g oil/100g HEPS and kg oil/kg HEPS **(3 marks)**

(iv) What is the recovery rate of the soxhlet method, and comment on the recovery rate of the soxhlet method? **(2 marks)**

(v) What difference would you expect on the oil content if you used a methanol:chloroform (1:1) organic solvent mixture to extract the oil in the soxhlet method? Explain your answer. **(2 marks)**

(vi) What other method would you use to determine the oil content in the HEPS?

(2 marks)

(c) To determine the ash content of the HEPS, you weighed a previously ignited crucible (23.0001g). You then weighed a sample on the crucible giving a total weight of 25.0311g. Thereafter, you transferred the crucible to a muffle furnace, which was heated at about 550 ^{0}C until the ash was nearly white after 4 hours. The furnace was then cooled to about 100 ^{0}C and the crucible was removed from the furnace and placed in the desiccator. After some 30 minutes in the desiccator, the crucible was weighed with its content giving a total weight of 24.8002g.

a) Calculate the ash content of the HEPS **(3 marks)**

b) What is the importance(s) of determining ash content in a food? **(4 marks)**

c) What other parameter(s) or properties of the HEPS can you determine from the obtained ash? **(3 marks)**

.....End of Exam.....

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/4 ACADEMIC YEAR FIRST SEMESTER FINAL THEORY EXAMINATION

AGF 3042 – Instrumental Methods in Food Analysis

INSTRUCTIONS

Answer **ALL** questions in **Section 1** and answer any **four (4)** questions in **Section 2**

Each question in **Section 1** is allocated marks as shown in **parenthesis**

All questions in **Section 2** carry equal marks of twenty **(20)** marks each

Time allowed: Three (3) Hours

SECTION 1: Answer ALL questions in this section in the provided booklet

1. One of the following statements is true. Mark the correct one? **(1 mark)**
    a. In competitive ELISA, the greater the intensity, the higher the analyte concentration.
    b. In indirect ELISA, the lower the color intensity, the higher the analyte concentration.
    c. In direct ELISA, the greater the color intensity, the lower the analyte concentration.
    d. In sandwich ELISA, the greater the color intensity, the higher the analyte concentration.
2. Which of the following techniques is associated with the IEP of proteins?**(1 mark)**
    a. Radial immunodiffusion
    b. Radioimmunoassay
    c. Electrofocusing
    d. PACIA
3. Which of the following enzyme is used as immobilised enzymes in ELISA **(1 mark)**
    a. Horse radish oxidase
    b. Acidic phosphatase

c. Alkaline peroxidase

d. Horse radish peroxidase

4. Which of these elements is not detectable by ECD **(1 mark)**

   a. Br

   b. I

   c. Na

   d. Cl

5. The following are all examples of alkali metals except _____ **(1 mark)**

   a. Rb

   b. Cs

   c. Na

   d. Mg

6. Which of the following has the longest wavelength? **(1 mark)**

   a. UV

   b. γ-rays

   c. RF

   d. Vis

7. Which of the following is true? **(1 mark)**

   a. DTA has one thermocouple while DSC has two thermocouples

   b. DSC has one heating element and DTA has two heating elements

   c. DSC and DTA each have one thermocouple

   d. DSC has one thermocouple while DTA has two thermocouples

8. Flame photometry is an _____ type of spectroscopy **(1 mark)**

   a. Absorption

   b. Emission

   c. Absorption and emission

   d. None

9. A reference cell is often prepared by all the following except one (circle one) **(1 mark)**

   a. Addition of distilled water
   b. Addition of solvents used but without the analyte
   c. Empty cell
   d. Addition of the analyte without the solvent

10. Intensity of colour increases proportionally with the sample concentration in all the following except: **(1 mark)**

    a. Liebermann–Burchard
    b. Flame Photometry
    c. Competitive ELISA
    d. Indirect ELISA

11. Briefly give two (2) differences between C-NMR and H-NMR **(2 marks)**

12. A particular food coloring has a molar absorptivity of 3.8×10^3 $cm^{-1}M^{-1}$ at 510 nm.

    a. What will be the absorbance of a 2×10^{-4} M solution in 1 cm cuvette at 510 nm?
    b. Calculate the % transmittance of the solution in (a.)

    (2 marks)

13. A sample containing 0.25 g of sucrose in 25 g solution is equivalent to _____ °Brix (show how you arrived at your final answer) **(2 marks)**

14. $CDCl_3$ and CD_3OD are used as solvents for preparing samples for NMR. Why are these solvents used? **(2 marks)**

15. A sample has a D-value of 3. What does this mean? **(2 marks)**

SECTION 2: Answer any four (4) questions in this section

1. Infrared (IR) spectroscopy is an important technique used in many food based laboratories. Answer the following questions:

   a. Compare and contrast a dispersive IR spectrophotometer and an FT-IR spectrophotometer **(10 marks)**

   b. Name and discuss three (3) advantages of FT over dispersive IR techniques **(10 marks)**

2. Discuss the technique called SDS - PAGE in detail. In your discussion, include aspects of instrumentation, preparation of samples, principles of separation of samples, etc **(20 marks)**

3.

   a. A third year Natural Science student tells you that she is often confused by three (3) terminologies and heard that you took a course in AGF 3042. She says the terms radioimmunoassay, radial immunoassay and fluorescence immunoassay are a problem to her. Using the knowledge acquired in this course, explain these terminologies to her making sure you clarify the differences between the three techniques. **(10 marks)**

   b. Discuss Competitive ELISA and show how it differs from Indirect ELISA **(10 marks).**

4. Draw spectra of the following techniques ensuring that all the axes are correctly labeled including peaks and other defining features of each spectra (20 marks)

   a. Mass Spectrometry **(5 marks)**

   b. Gas Chromatography **(5 marks)**

   c. NMR Spectrometry **(5 marks)**

   d. DSC Thermogram **(5 marks)**

P.T.O.

5.

a. Discuss the analytical technique called polarimetry (principles, applications, etc) **(10 marks)**

b. Define refractometry and explain the factors that affect it **(10 marks)**

THE END

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

2013/2014 END OF YEAR FINAL EXAMINATION

AGF 3100 – GENERAL & FOOD MICROBIOLOGY (PRACTICAL)

ALLOWED TIME: 3 Hours

Instructions

- **Answer section A and section B in separate answer booklets**
- You are allowed to use a certified calculator

SECTION A (GENERAL MICROBIOLOGY)

Answer all questions in section A

All questions carry equal marks

Bacteriology

Q1. Describe the slide observations on the morphological arrangement of *Staphylococcus* bacteria.

Q2. a. What is an anaerobic bacterium?

b. Provide 2 species of anaerobic bacteria?

c. What instrument is used to grow anaerobic organisms?

Q3. List the various shapes of Bacterial organisms.

Q4. Briefly, how is Gram negative bacteria differentiated from Gram positive organisms on a stained slide?

Q5. List 2 examples of bacteria belonging to Gram negative and Gram positive grouping respectively.

Virology

Q6. a) Design and describe how to perform a One Step Growth Experiment in the case where a new virus has been found.

b) What is the unique feature of the One Step Growth Experiment?

Q7. a.) Draw a sketch of the basic structure of a virus particle?

b.) Enveloped viruses are less stable than non-enveloped viruses in the environment. Explain why?

Q8. a.) What equipment is used for the visualization of a virus particle in the laboratory and why do we require to use that kind of equipment to visualize the virus particle?

b.) Make a diagram to differentiate a virus from a prion.

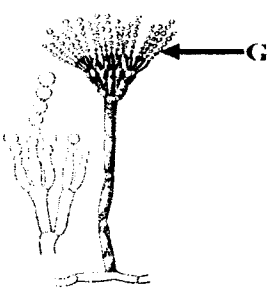
c.) Capsid *(sometimes referred to as nucleocapsid):* This is the protective protein shell surrounding the viral genome. Using the equipment referred to in a.) above, you will see the capsid. Name the two major classes of capsid symmetry.

Mycology

Q9. SABOURAUD'S DEXTROSE AGAR

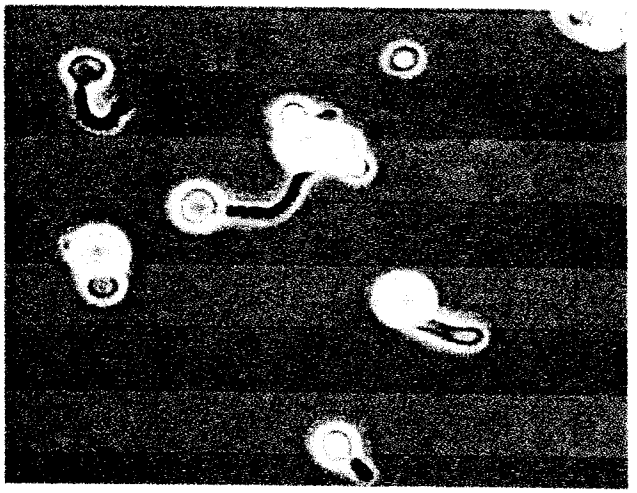
a) What is the composition of this medium?
b) What is it used for?
c) Describe the conditions employed for microbial growth using this medium.

Q10. A sample from a broiler chicken that exhibited respiratory distress and died was cultured in the laboratory. The isolate was examined microscopically and structure "G" was observed.



a) Identify structure "G"?
b) What could be the genus, and possibly the species of the organisms that caused disease in the broilers? Give reasons for your answer.

Q11. A culture of faecal sample from a calf with diarrhea was examined microscopically.

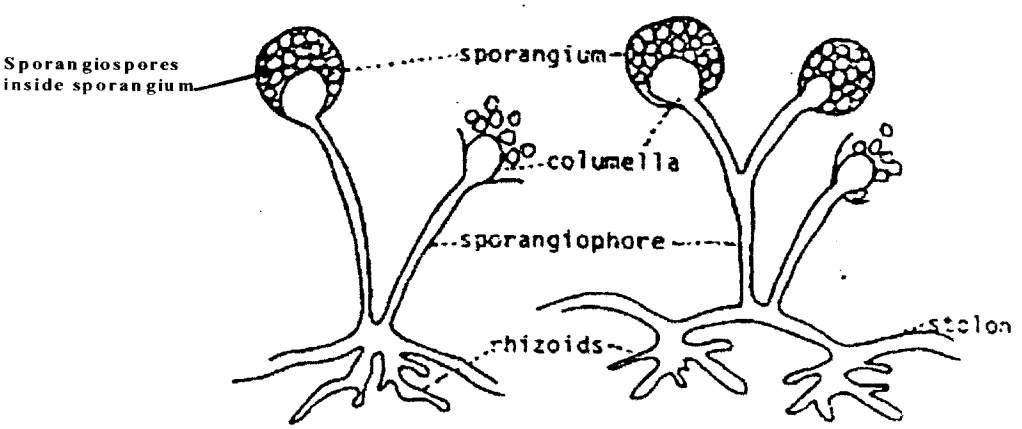


a) Describe your microscopic observations shown above.
b) Describe the culture conditions/procedure used and the basis of the procedure.
c) What could be the genus, and possibly the species of the organisms that caused disease in the calf? Give reasons for your answer.

Q12. LACTOPHENOL COTTON BLUE MOUNTING SOLUTION

a) What is the significance of this mounting solution?
b) Describe the procedure and importance (interpretations involving this mounting solution in the identification of microbial cultures in the laboratory.

Q13. Microscopic examination of a cultured sample from aborted material of a cow revealed the following observations.



a) Describe your microscopic observations shown above.
b) Fungi have 3 major types of spores. Which group of fungal spores do the above microscopic observation belong to?
c) Name one (1) organism, at least at the genus level, that exhibit such morphologies.

SECTION B (FOOD MICROBIOLOGY)

Answer all questions in this section.

1. A food sample was diluted by placing a 0.1 mL aliquot into 0.9 mL of diluent, and 1 mL of this dilution was pour-plated. After incubation, 217 colonies appeared. What is the CFU/mL in the original specimen? **(2.5 marks)**

2. A culture was diluted by adding a 0.1 mL aliquot to 0.9 mL water. Then, 0.1 mL of this dilution was plated out, yielding 73 colonies. Calculate the CFU/100 mL in the original culture. **(2.5 marks)**

3. 100 mL of drinking water was passed through a millipore filter, and the membrane was layered on a pad supplied with the M-Endo MF medium. 35 red colonies formed.

a. Calculate the number of coliforms counted per mL. **(5 marks)**
b. Calculate the number of coliforms counted per 100 mL. **(5 marks)**
c. Does this drinking water meet the standards for drinking water? **(5 marks)**
d. What type of micro organisms would you expect in bottled water? Name at least two. **(5 marks)**
e. Why do the micro organisms you have mentioned grow in the water while others don't? **(5 marks)**

Hint: WHO guidelines for potable water is 0 coliforms/100 mL

.....End of Exam.....

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

2013/2014 ACADEMIC YEAR - FINAL EXAMINATIONS

AGF 3412: FOOD TOXICOLOGY

TIME: Three (3) Hours
INSTRUCTIONS:

(i) There are six questions in this paper. Answer all questions. Both sections have equal marks.
(ii) Answer each of the two sections in a separate answer booklets, and clearly label the answer booklets as Section A and Section B.

SECTION A

QUESTION 1

Describe in detail how the toxicants are distributed in the body and also describe the factors affecting their distribution. **[20 marks]**

QUESTION 2

(a)Name and describe the three major and three minor routes of excretion and why is the excretion of toxins important? **[10 Marks]**

(b) What are the two major structural barriers that restrict the entrance of toxicants into certain organs and tissues of the body and how do they function? **[10 Marks]**

QUESTION 3

List and describe the three phases of transforming a cell into cancerous one. How can the proliferation of cancer cells be prevented **[10 Marks]**

Section B (Next page)

SECTION B

QUESTION 1

Define the following terms and state their importance in food toxicology

(i) Anti-nutritional factor **[2 marks]**

(ii) PCBs **[2 marks]**

(iii)Cadmium **[2 marks]**

(iv)Allergen **[2 marks]**

(v) Saxitoxin **[2 marks]**

QUESTION 2

Fungi are microorganisms that can produce secondary metabolites in animal feed and human food ingredients that cause adverse biological effects when consumed in sufficient quantities, over time. Write about any four (4) fungal toxicants emphasizing on what they are and how they affect human health **[20 marks]**

QUESTION 3

Cyanogens are one of the classes of toxicants of plant origin. Write about cyanogens': (i) form of occurrence, (ii) food sources, (iii) with the help of chemical reactions, explain what makes them toxic, and (iv) three ways in which they are detoxified in the body **[20 marks]**

.....End.....

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2013/14 ACADEMIC YEAR - FINAL EXAMINATION

AGF 4052 – Sensory Evaluation of Foods

INSTRUCTIONS:

(i) There are five questions in this paper. **Question 1 is compulsory**. Out of questions 2 to 5, answer **any three** questions. Marks allocated to each question are as indicated at the end of each question.

(ii) 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

TIME ALLOWED: Three (3) Hours

QUESTION 1 (Compulsory)

A company was developing a peanut-honey butter blend. They developed three prototypes branded as PHBB-1, PHBB-2 and PHBB-3. Ten (10) panelists assessed for the quality of the three peanut-honey butter blends on a given scale. Each panelist tested the three prototypes. Each of the panelists scored: 13, 14 and 13; 14, 15 and 12; 14, 15 and 13; 12, 14 and 12; 14, 14 and 12; 15, 13 and 13; 13, 15 and 12; 13, 12 and 12; 14, 14 and 12; and 15, 14 and 13, for the PHBB-1, PHBB-2 and PHBB-3, respectively. Assume the scores to come from normally distributed data and having come from populations with the same variance.

(a) Based on the above results, did the panelists perceive the three peanut-honey blend prototypes to be different in quality? **[12.5 marks]**

(b) Which prototype would be considered different by consumers, if any? **[5 marks]**

(c) Would you use the panelists used in this test again? Give reason(s) why you would or would not use them again **[12.5 marks]**

NOTE: LSD = t*SQRT(2*MS_E/n)

(a) 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

(a) Write short notes (max. 5 sentences) on the following terms used in sensory evaluation of foods:

(i) Organoleptic **[2 marks]**

(ii) Spectral reflectance graph **[2 marks]**

(iii) Somesthetic perception **[2 marks]**

(iv) Lab color space **[2 marks]**

(v) Texture profile curve **[2 marks]**

(b) There are six major sensorial perceptions that a human being uses in the evaluation of foods. Write about any four (4) of the sensory perceptions in terms of the following:

(i) For each of the four, briefly define what it is **[4 marks]**

(ii) For each of the four, state and explain some of the sensory concerns about these perceptions which can affect the abilities of the panelists to evaluate food **[6 marks]**

QUESTION 3

(a) In sensory evaluation,

(i) What are overall and attribute difference tests? **[2 marks]**

(ii) Mention three (3) overall difference and three (3) attribute difference tests **[3 marks]**

(b) Presentation of the matched pair in a simple difference test enables the sensory analyst to evaluate the magnitude of the "placebo effect" of simply asking a difference question."

(i) What is meant by "placebo effect?" **[2 marks]**

(ii) Justify this statement. **[2 marks]**

(c) 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? **[3 marks]**

(d) State the similarities and differences between the following:

(i) Grading vs ranking in quality evaluation **[3 marks]**

(ii) Ordinal vs interval data **[3 marks]**

(iii) Category vs linear scaling **[2 marks]**

QUESTION 4

(a) Give six (6) applications of descriptive analysis in sensory evaluation? **[3 marks]**

(b) The definition of thresholds in sensory evaluation has various dimensions. Mention and adequately define four (4) terms, with an example for each, used to define threshold. **[7 marks]**

(c) There are a number of descriptive analysis methods that have been developed in descriptive analysis techniques, which are valuable tools in modern sensory science for foods. Two of the commonly used descriptive test methods are Spectrum Method and Free-Choice Profiling Method. Separately, describe these two methods. For Free-Choice Profiling Method, also outline its limitations **[10 marks]**

QUESTION 5

A drink manufacturer wishes to replace his regular preservative, potassium sorbate, with a newly introduced preservative 'mwenge' on the Zambian market. It has been proven that the new preservative is as effective as the regular preservative in its preservative properties. The new preservative is also cheaper than the regular preservative. The company marketing the new preservative claims that the drinks made using 'mwenge' preservative tastes the same as that made using potassium sorbate. However, it's a known fact that both preservatives cause carryover taste effects when the drinks are tasted. The drink manufacturer would like to know if the drinks made using 'mwenge' preservative tastes the same as that made using potassium sorbate. Therefore, the drink manufacturer hires you as a Sensory Consultant. The drink manufacturer would like you to determine if the new 'mwenge' preservative can be used in place of potassium sorbate. Secondly, the drink manufacturer would like you to determine if the two types of drinks produced by the two preservatives can be distinguished by taste. To provide the drink manufacturer with the information to his queries, you conducted a sensory test. In this sensory test, you obtained a total of 70 responses, 35 matched and 35 unmatched pairs, collected from 70 panelists. Each panelist evaluated either a matched pair (K-Sorbate/K-Sorbate or mwenge/mwenge) drinks or unmatched pair (K-Sorbate/mwenge or mwenge/K-Sorbate) drinks in a single session. Within the matched pairs, 20 panelists said the samples were the same and 15 panelists said the samples were different. On the other hand, in the unmatched pairs, 24 panelists said the samples were different and 11 panelists said the samples were the same.

(i) State with reason(s) what kind of sensory test you carried out to obtain this kind of data **[2 marks]**

(ii) Give advice, outlining your basis, to the drink manufacturer regarding his queries above **[14 marks]**

(iii) What decision is the drink manufacturer likely to make? **[4 marks]**

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

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/4 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

AGF 4065 – Nutrition

INSTRUCTIONS
Answer **ALL** questions in **Section 1** and answer any **three (3)** questions in **Section 2**
Each question in **Section 1** is allocated marks as **shown in parenthesis**
All questions in **Section 2** carry equal marks (**20 marks each**)

Time allowed: Three (3) Hours

SECTION 1: Answer all questions in this section

1. Define the acronym RDA (**2 marks**).
2. List four (4) risk factors of cardiovascular diseases (**2 marks**).
3. **True or False:** Osteoporosis is an exclusively feminine problem (**1 mark**).
4. The removal of the pancreas would result in a condition called_____ and require _____ therapy to continue to effectively manage this condition (**2 marks**).
5. Give two (2) variations of water compositions in human beings (**2 marks**).
6. A dietary assessment that requires a collection of food consumed within 24 hours is called _____ (**1 mark**).
7. **True or False:** Force feeding is very important in the prevention of malnutrition (**1 mark**).
8. Phytonutrients have been linked to the prevention of _____ (**1 mark**).
9. Which form of severe malnutrition usually leads to lethargy and irritability? (**1 mark**)
10. Name two (2) important interventions aimed at addressing micronutrient problems in Zambia (**2 marks**).
11. Ideally, the best measurement of obesity would be a measure of the actual body fat although such methods are expensive. Name two (2) such techniques (**2 marks**).
12. The small intestine is the primary site for absorption in the body and it is divided into three main regions namely _____, _____ and _____ (**3 marks**).
13. Starch is made up of two polymers namely amylose and amylopectin. Draw the structures of these two polymers. (**5 marks**)

14. Give two (2) functions of calcium in the human body (**2 marks**).

15. Briefly explain the relationship of alcohol and flushing in human beings (**3 marks**)

SECTION 2: Answer any three (3) questions in this section

1. Starch is divided into three (3) fractions depending on their digestion rates

a. Describe each of these fractions and indicate the times associated with them when measured *in vitro* (**6 marks**)

b. Each of these starch fractions has a relationship to the health of humans. briefly explain how each of these three (3) fractions can influence the health of a human being (**6 marks**)

c. Outline how the digestion of carbohydrates progresses in the human being from ingestion to defecation. Indicate the enzymes and controlling hormones responsible for different aspects of the digestive process (**8 marks**).

2. Discuss the relationship of alcohol (ethanol) intake and body tissue and / organ damage (**20 marks**)

3. A growth monitoring promotion (GMP) card is attached to this paper. Answer the following questions based on your knowledge and also based on this GMP card.

a. Currently, in a number of developing countries including Zambia, there is a campaign known as the 1000 Most Critical Days (1000-MCD) going on. How was this number (1000) arrived at? (**2 marks**)

b. Of what significance are the components that were used to arrive at the number (1000)? (**2 marks**)

c. What nutrition index can be accessed from the GMP card attached and what condition or nutrition status does that index represent? (**4 marks**)

d. Two (2) other indices could be assessed from this card but are currently not determined from such a GMP card

i. Give names of these two (2) other indices and what nutrition status each of them represents (**4 marks**)

ii. What anthropometric measurement would best be placed in this GMP to determine these two nutrition indices? (**2 marks**)

P.T.O

e. What is the economic importance of including the anthropometric measurement in this GMP card in Zambia? (**6 marks**)

4. Obesity is closely associated with morbidity and increased mortality. Discuss how this is citing at least four (4) cases of obesity related morbidities. (**20 marks**)

THE END

Child's name: _____

IMMUNISATIONS

BCG

Polio 0 1 2 3

Hib, DTP & Hep B 1 2 3

Measles

birth 6wks 10wks 14wks 9mths

DTP 4

Polio 4

Measles 2

18mths

Discuss:
- Breastfeeding
- Child spacing
- Food intake
- Oral rehydration solution

97th centile

50th centile

3rd centile

60% of 50th centile

I can talk

Birth weight

age in months

write birth month and year

Birth to 1 Year

write birth month

1 to 2 Years

write birth month

2 to 3 Years

Growth Monitoring Chart

Chart revised: August 2002

jib

Watch the direction of the curve showing the child's growth

GOOD
Means the child is growing well

DANGER SIGN
Not gaining weight. Find out why.

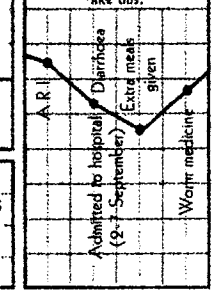
VERY DANGEROUS
Child may be ill, needs extra care.

Date for next visit

nr.	day	month	year
1	/	/	
2	/	/	
3	/	/	
4	/	/	
5	/	/	
6	/	/	
7	/	/	
8	/	/	
9	/	/	
10	/	/	
11	/	/	
12	/	/	
13	/	/	
14	/	/	
15	/	/	
16	/	/	
17	/	/	
18	/	/	
19	/	/	
20	/	/	
21	/	/	
22	/	/	
23	/	/	
24	/	/	

Write on the chart
- Any illness e.g.
  - ~ diarrhoea,
  - ~ ARI, etc.
- Admission to hospital,
- Solids introduced,
- Breastfeeding stopped
- Birth of next child, etc.

like this:



THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013 / 4 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

AGF 4210 – Unit Operations in Food Engineering

Instructions

Answer a total of **five (5)** questions from this paper

Answer **one (1)** from each of the **four (4)** sections and **a fifth (5th)** question from any section of your choice

Answer **each question** in a **separate booklet**

Time allowed: Three (3) Hours

SECTION 1: Answer one (1) question from this section in a separate booklet

1. A distillation unit was assembled to handle a feed of 100 kg mol / h containing 45 mol % X and 55 mol % Y. The feed enters at a temperature of 327.6 K. A distillate containing 95 mol % X and 5 mol % Y and a bottoms product containing 10 mol % X and 90 mol % Y is expected to be obtained. The reflux ratio is 4: 1. The average heat capacity of the feed is 159 KJ / kg mol. K and its boiling point is 366.7 K, and the average latent heat is 32099 KJ / kg mol. **Table 1** shows the data for the equilibrium line. Answer the following questions based on this question:

Table 1: Data for equilibrium line for distillation unit

x_A	0	0.130	0.258	0.411	0.581	0.78	1.0
y_A	0	0.261	0.456	0.632	0.777	0.90	1.0

a. Calculate the minimum reflux ratio, R_{min} **(6 marks)**

b. Find the minimum number of theoretical plates in this tower **(4 marks)**

c. Discuss the five (5) main components of a distillation column and then draw a diagram showing all these parts **(10 marks)**

2. An oil solution was tainted with a yellow-greenish colour that was identified as a pigment from the soybean used for oil extraction. It was suggested that activated carbon be used to remove the pigment from the oil. Equilibrium data of this process is shown in **Table 2** and the removal of the pigments is reported to obey the Freundlich isotherm. Answer the following questions about this process.

Table 2: Equilibrium data given for the removal of pigments from oil sample using activated carbon

	c (kg pigment / m^3 oil solution)	q (kg pigment / kg activated carbon)
a.	0.322	0.15
	0.117	0.122
	0.039	0.094
	0.0061	0.059
	0.0011	0.045

a. What was the name of the unit process used to remove the pigments?
(2 marks)

b. At what temperature (freezing / room / boiling/ etc) do you expect that the operation to have been carried out for the most effective separation
(1 mark)

c. After the removal of the pigments, it is realized that it would have been costly to throw away the activated carbon. How can the activated carbon be regenerated for future use? **(2 marks)**

d. Draw the appropriate graph associated with the isotherm and determine the equation for this isotherm and derive the values of k and n of the formula associated with the Freundlich isotherm **(15 marks)**

P.T.O.

SECTION 2: Answer one (1) question from this section in a separate booklet

1. A hot solution of $Ba(NO_3)_2$ from an evaporator contains 23.4% $Ba(NO_3)_2$ and goes to a crystallizer where the solution is cooled and $Ba(NO_3)_2$ crystallizes. On cooling, 10% of the original water present evaporates. For a yield of 17.47kg $Ba(NO_3)_2$ crystals;
   a. Calculate the feed solution if the solution is cooled to 290K, where the solubility is 8.6kg $Ba(NO_3)_2$ / 100kg total water. **(15 marks)**
   b. A condensed milk manufacturer informs you that he is using a vertical-type natural circulation evaporator to concentrate his product. He further explains that his product has a burnt flavour and a brown color. Explain the cause of the problem and offer possible solutions. **(5 marks)**

2. A single-effect evaporator is concentrating a feed of 9020 kg/h of a 10% solution of NaOH in water to a product of 50% solids. The pressure of the saturated steam used is 42 kPa (gauge) and the pressure in the vapour space of the evaporator is 20 kPa (absolute). The overall heat-transfer co-efficient is 1988 $W/m^2.K$.
   a. Calculate the steam used, steam economy, and the area if the feed temperature is 15.6°C. The heat capacity of the feed is 4.06kJ/kg.K. **(15 marks)**
   b. Discuss three ways in which super-saturation can be attained and give an example of the type of crystallizer for each of these. **(5 marks)**

P.T.O.

SECTION 3: Answer one (1) question from this section in a separate booklet

1. A frictionless, incompressible milk based beverage with a density of 1100 kg/m^3 flows in a pipeline from the pasteurizer to the storage tank. At a point where the diameter is 15 cm, the fluid velocity is 2 m/s, and the pressure is 300 kPa.

   a. Determine the pressure at the point 10 m downstream, where the diameter is 5 cm if the pipe is horizontal **(7 marks)**

   b. What would the pressure at the point 10 m downstream, where the diameter is 5 cm if the flow were vertical downward? **(7 marks)**

   c. Differentiate between Newtonian and Non Newtonian fluids **(6 marks)**

2. In the process of producing concentrated juice, a fresh extracted and strained juice containing 10 wt % solids is evaporated in the first evaporator, giving 18 wt % solids in the juice. This is fed to a second evaporator, which gives 50 wt % concentrated juice as a final product.

   a. Draw and clearly label the process flow diagram **(4 marks)**

   b. Calculate the amount of water removed from each evaporator **(6 marks)**

   c. Calculate the amount of product produced (concentrated juice) **(6 marks)**

   d. What does the law of conservation of mass state? Is it holding in the above process? Show by performing a check either on a component or on the overall process **(4 marks)**

P.T.O.

SECTION 4: Answer one (1) question from this section in a separate booklet

1.

a. Define the term Pneumatic Conveyance and briefly explain the mechanism of operation for each of the three basic designs of pneumatic transport systems.

(2 marks)

b. Use simple sketches to illustrate the mechanism of operation for the following equipment.

I. Star Type Feeder
II. Apron Feeder
III. Rotary Plow feeder

(6 marks)

c. Six hundred (600) kg of powder is fluidized in a vessel of cross sectional area $1m^2$ and achieved a bed height of 0.5 m

I. Calculate the bed density?
II. Given that the particle density of these particles is 2700 kg/m^3, calculate the bed voidage.

(4 marks)

d. A material consisting originally of 25 mm particles is crushed to an average size of 7 mm and requires 20 kJ/kg for this reduction. Determine the Energy required to crush the material the material from 25 mm to 3.5 mm assuming:

I. Rittinger's Law
II. Kick's Law

(8 marks)

2.

a. List four main types of Mechanical Separation and briefly explain the mechanism of operation for each one of them.

(4 marks)

b. Use simple sketches to illustrate and explain the mechanism of operation for the following equipment.

I. Cyclone separator
II. Liquid centrifuges - Conical bowl
III. Liquid / Solid centrifuges - Horizontal bowl

(6 marks)

c. Explain in detail the Mixing Mechanism and the flow patterns for the following Stirred Tanks. Discuss how you can minimize vortex formation for each one.

I. FBT - Flat bladed Turbine

II. PBT - Pitched Bladed Turbine

(6 marks)

d. What is the power required to crush 1000 ton/h of particles if 80 % of the feed pass a 50 mm screen and 80 % of the product a 3.2 mm screen? The work index for limestone is 12.74

(4 marks)

END OF EXAMINATION

GOOD LUCK!

Data for the Examination

$F = D + B$

$x_D / R_D + 1$

$R_m / R_m + 1 = (x_D - y') / (x_D - x')$

$R_m = (x_D - y') / (y' - x')$

$q = 1-f$

$- q / 1-q$

$$q = \frac{(H_V - H_L) + C_{pL} (T_B - T_F)}{H_V - H_L}$$

$q = kc^n$; Slope = 1/n and intercept = log k

$$q = \frac{q_o c}{k + c}$$; Slope = k/q_o and intercept = $1/q_o$

$L_o + V_2 = L_1 + V_1 = M$

$x_{si} = p / (p + 1)$

$C_p = 1.424\ m_c + 1.549\ m_p + 1.675\ m_f + 0.837 m_a + 4.187 m_m$

$C_p = 1.675 + 0.025\ w$

$\Delta H = mc\ (T_2 - T_1)$

$\Delta H_s = m_s H_s$ or $\Delta H_s = m_c H_c$

From steam tables

$H_{s,543.1} = 2746.5$ kJ / kg $H_{c,155} = 627$ kJ / kg

$\Lambda = Hs- hs$

$F = L+ V$

$Fx_F = Lx_L$

$q = U A \Delta T$

$q = S(Hs-hs)=S\lambda$

$q = (H_2 + Hv) – H_1$

Molar weights for select elements

Ba =	137.33	N	=	14.01
$MgSO_4$ =	120	H	=	2
O =	16	K	=	39.1
Cl =	35.45			

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/14 ACADEMIC YEAR MID - YEAR

FINAL EXAMINATION

AGF 4221: PROCESS CONTROL AND INSTRUMENTATION

TIME : THREE HOURS

INSTRUCTIONS:

There is a Total of **Six (6) questions** in this paper. Answer any **five questions**.
All questions carry equal marks. Use illustrations in your answers where necessary.

1.

a) Discuss a system that exhibits first order dynamics. What are the principle characteristics of this system?

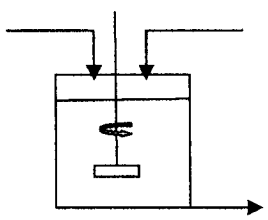
b) List the Characteristics of a feedback control system. Give an example to illustrate this kind of system.

c) A control scheme is a plan by which we intend to control a process. List four steps that are involved in developing a control scheme for the blending tank and explain briefly each step.

d) Label the diagram below which shows an incomplete control system for maintain the pH of a liquid at a required pH, given that the Acid and the NaOH are both added to the tank using separate streams and that the liquid in the tank is kept at a desired level.

i. Complete the control system and show all the necessary equipment working together.

ii. Develop a Block diagram for the feedback control system showing both streams. Clearly show which stream you choose to manipulate.



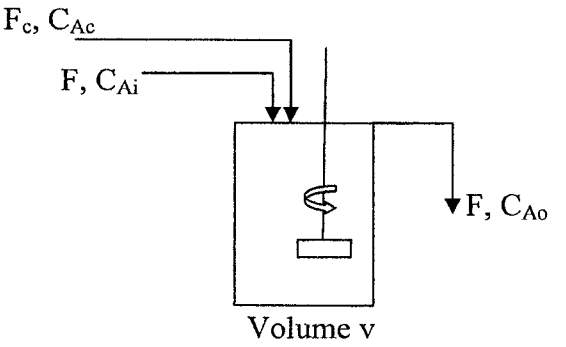
2.

a) Explain in detail the stability of a system. Give an example.

b) Explain in detail the term 'deviation from reference conditions'. Show how the physical variable can be recovered.

c) Consider a system's response which is defined by $y = y_H + y_1 + y_2$. Given that y_H decays toward zero from IC, that y_1 is the response to a step disturbance occurring at $t_1 = 1$, with gain of 3 and y_2 is the response to a step disturbance occurring at $t_2 = 2$ with gain of -4. Give analysis of this system's response.

d) The diagram below shows concentration control in a blending tank. Develop a material balance, express this balance in terms of deviation variables.



3.

a) Given that the control objective for a process is to keep the store house of fruit at a desired temperature set on the thermostat by the care-taker, in spite of unmeasured disturbances such as heat loss from the doors and windows opening, heat loss through the walls of the house. Develop a sketch showing all the necessary equipment working together.

b) Develop a detailed block diagram for the process given in question no. (3.a)

c) Given that the overall material balance of an ideal process of filling a tank is presented below. Express the tank Volume in terms of the liquid level h (height of tank) and hence find the liquid lever h as a function of time.

$$\frac{d\rho V}{dt} = \rho F_i$$

d) Illustrate how a first order dynamic system would respond to the following disturbances.

I. Step disturbance.

II. Pulse disturbance.

III. Sine disturbance.

4.

a) Develop a block diagram for an open-loop system. Explain in detail its ability to perform accurately? Give an example.

b) Develop a block diagram of a two-input control system in a home shower with separate valves for hot and cold water who's main objective should be to obtain a desired temperature of the shower water and flow rate. Explain the significance of this system.

c) The variable $y\ (t)$ depends on its first derivative and forcing function $x\ (t)$ such that at $t = t_0$, $y = y_0$. Given the following equation, find the general solution.

$$a(t)\ \frac{dy}{dt} + y(t) = K\,x(t)$$

d) With the help of a simple sketch, devise a Control System to fill a container with water after it is emptied by a stopcock at the bottom. The system must automatically shut off water when the container is filled. Considering that this system is first order system, develop a material balance expressing the liquid level as a function of time and explain the term t_{fill}.

5.

a) Define the following terms and give an appropriate example;
   - **I.** Process.
   - **II.** Manipulated variable.
   - **III.** Controlled variable.

b) Given that x is a step function at t_1 and that the response y will decay toward zero from IC y_0. At t1 the system will respond to being hit by a step disturbance. Illustrate how this system will respond to this disturbance.

c) Draw a Schematic block diagram of a home geyser system. Identify the functions of each element of the thermostatically controlled geyser and system. What improvements would you make to this system and why would they be necessary.

d) Develop a block diagram for a control system for the opening of a vent when the temperature rises in a greenhouse or store house of vegetables.

6.

a) Explain the importance of mathematical modeling of a process in Process control.

b) Given that the control objective for a process is to keep the store house temperature at a desired temperature set on the thermostat by the home owner, in spite of unmeasured disturbances such as heat loss from the doors and windows opening, heat loss through the walls of the house. Develop a sketch of this system showing all the necessary equipment working together.

c) Develop a block diagram for the system in question no. (6b).

d) Develop a set of control algorithms using the controller error for the control system working in automatic that will involve measurement and action.

THE END

The University of Zambia

School of Agricultural Sciences

Department of Food Science and Technology

2013/2014 End of Year Academic Examination

Course: Fundamentals of Biochemical Engineering (AGF 4232)

Date of Exam: 30th July, 2014

Time Allowed: 3 Hours

Instructions to the candidate

- Ensure that your computer number is written on the provided answer sheets
- Indicate the questions you have answered in the provided answer sheet
- **There are six (6) questions in this paper. Question 1 is compulsory. In addition, answer any other four (4) questions**
- Question 1 carries 30 marks. The rest carries 17.5 marks
- The use of a certified scientific calculator is allowed

1. Suppose you have an organism that obeys Monod equation:

$$\frac{dC_x}{dt} = \frac{\mu_{max} C_s C_X}{K_s + C_s}$$

Where $\mu_{max} = 0.5\ h^{-1}$ and $K_s = 1\ g/L$. The organism is being cultivated in a steady state CSTF, where F = 100 L/h, C_{Si} = 50 g/L and $Y_{X/S}$ = 0.5.

a. What size of vessel will give the maximum total rate of cell production? **(2 marks)**

b. What are the substrate and cell concentrations of the optimum fermenter in (a). **(8 marks)**

c. If the exiting flow from the fermenter in part (a) is fed to a second fermenter (CSTF), what should be the size of the second fermenter to reduce the substrate concentration to 1 g/L? **(10 marks)**

d. If the exiting flow from the first fermenter in part (a) is fed to a second fermenter whose size is the same as the first fermenter, what will be the cell and substrate concentrations leaving the second fermenter? **(10 marks)**

2. a. State the name of small portions of enzymes on which chemical reactions are catalysed. **(0.5 mark)**

b. List any two differences between an enzyme reaction and a chemical reaction. **(1 mark)**

c. State the use of the following medical enzymes:

i. streptokinase and **(1 mark)**

ii. rhodanase **(1 mark)**

iii. For each enzyme named above, write the reaction it catalyses **(1 marks)**

d. Describe the effect of substrate concentration on the rate of enzymatic reactions. How would you experimentally find the values of constants r_{max} and K_M. **(3 marks)**

e. The luciferase enzyme in fireflies catalyzes the modification of luciferin, consuming both luciferin and ATP, and producing light. Assuming ATP is in excess, the reaction follows the Briggs-Haldane mechanism, with luciferin as the limiting substrate. A series of experiments are performed in which 5 μM luciferase enzyme is mixed with various concentrations of substrate C_{so}, and the relative reaction rates are measured in terms of light emission rates, measured using a photomultiplier tube:

C_{so} (μM)	Relative light units (RLU)
5	3554
10	6262
20	10115
40	14611
80	18786
200	22672
500	24718
1000	25484

Using the Lineweaver-Burk plot, estimate: (plotting = **5 marks**)

i. The r_{max} (in RLU) and **(2.5 marks)**

ii. K_M (in μM) **(2.5 marks)**

3. a. Define enzyme immobilisation **(1 mark)**

b. Explain how each of the following methods of immobilisation is done:

i. entrapment **(1.5 marks)**

ii. adsorption **(1.5 marks)**

iii. covalent attachment **(1.5 marks)**

c. For each of the following fermenters, list two (2) advantages and two disadvantages:

i. airlift fermenter **(2 marks)**

ii. bubble column fermenter **(2 marks)**

d. State two methods which are used for vinegar production. For each method, briefly explain how vinegar is produced. **(4 marks)**

e. What are uses of the following products of biotechnology in the food industry:

i. Citric acid **(2 marks)**

ii. Branched amino acids of valine and leucine **(2 marks)**

4. a. The change of cell number density with time is expressed as $r_n = \frac{dC_n}{dt} = \mu C_n$

   i. What does the symbol μ represent? **(0.5 mark)**

   ii. State the unit for μ **(0.5 mark)**

   iii. Using the above equation, show that $t_d = \frac{\ln 2}{\mu}$ **(4.5 marks)**

   b. A microorganism is cultured in a 10 L batch bioreactor, which initially contained 100 g/L growth substrate (considered to be a "high" concentration) and 0.2 g/L biomass. You are told by a colleague that the doubling time for this culture (in exponential phase) is very reproducible, with t_d = 1.25 hours. After 6 total hours in culture, you measured the cell density and substrate concentration: t = 6 h: C_n = 1.24 g/L; C_s = 73 g/L. Estimate:

   i. The maximum specific growth rate, μ_{max} (h^{-1}). **(6 marks)**

   ii. The yield coefficient, $Y_{X/S}$ (g biomass/g substrate). **(6 marks)**

5. An enzyme with K_M of 1 x 10^{-3} M was assayed using an initial substrate concentration of 3 x 10^{-5} M. After 2 min, 5% of the substrate was converted into the product.

   a. How much substrate will be converted after:

   i. 10 min and **(5 marks)**

   ii. 30 min. **(5 marks)**

   b. How long must the reaction run to achieve 99% conversion? (assume that the enzyme follows Michaelis-Menten kinetics). **(7.5 marks)**

6. Biochemical engineering processes are very useful in the food industry and have the potential of enhancing the food security situation in Zambia.

   a. Give a brief overview of the application of biochemical engineering techniques in the food industry sector in Zambia. **(7 marks)**

   b. Outline four disadvantages of the biological process that are used in the Biochemical engineering techniques in the food and other related industries. **(8 marks)**

   c. In your own opinion, do you think this technology is totally new? **(2.5 marks)**

FORMULAE LIST

$$C_S = \frac{K_S}{\tau_m \mu_{\max} - 1}$$

$$Y = \frac{C_X - C_{X_0}}{C_{S_0} - C_S}$$

$$D_2 = \frac{\mu_2 C_{X_2}}{C_{X_2} - C_{X_1}}$$

$$\frac{1}{r} = \frac{1}{r_{\max}} + \frac{K_M}{r_{\max}} \frac{1}{C_S}$$

$$C_S = \frac{DK_s}{\mu_{\max} - D}$$

$$C_X = Y\left(C_{S_0} - \left[\frac{DK_S}{\mu_{\max} - D} \right] \right)$$

$$r = r_{\max} - K_M \frac{r}{C_S}$$

$$D = \frac{\mu_{\max} C_s}{K_S + C_S}$$

$$D = \mu = \frac{1}{\tau_m} = \frac{\mu_{\max} C_S}{K_S + C_S}$$

$$K_M \ln \frac{C_{S0}}{C_S} + (C_{S0} - C_S) = r_{\max} t$$

$$r_P = \frac{r_{\max} C_S}{K_M + C_S}$$

$$C_{X,opt} = Y C_{S_0} \frac{\alpha}{\alpha + 1}$$

$$\frac{C_X}{\tau_m} = r_X = \frac{\mu_{\max} C_S C_X}{K_S + C_S}$$

$$\alpha = \sqrt{\frac{K_S + C_{S_i}}{K_S}}$$

$$C_{S,opt} = \frac{C_{S_0}}{\alpha + 1}$$

$$\tau_{m,opt} = \frac{\alpha}{\mu_{\max}(\alpha - 1)}$$

$$\frac{1}{\mu} = \frac{K_S}{\mu_{\max}} \frac{1}{C_S} + \frac{1}{\mu_{\max}}$$

$$C_{X_1} = Y\left\{ C_{S_0} - \frac{D_1 K_S}{\mu_{\max} - D_1} \right\}$$

$$(\mu_{\max} - D_2) C_{S_2}{}^2 + \left\{ \frac{D_1 D_2 K_S}{\mu_{\max} - D_1} - D_2 K_S - \mu_{\max} C_{S_0} \right\} C_{S_2} + \frac{D_1 D_2 K_S{}^2}{(\mu_{\max} - D_1)} = 0$$

$$\frac{C_S}{r} = \frac{K_M}{r_{\max}} + \frac{C_S}{r_{\max}}$$

$$C_{S_1} = \frac{D_1 K_S}{\mu_{\max} - D_1}$$

$$\frac{C_{S_0} - C_S}{C_X} = \frac{K_e}{YD} + \frac{1}{Y}$$

$$\frac{\mu_{\max} C_S}{K_S + C_S} = YD \frac{(C_{S_0} - C_S)}{C_X}$$

$$\frac{C_{so} - C_s}{ln^{C_{so}}/_{C_s}} = -K_m + \frac{r_{max} t}{ln^{C_{so}}/_{C_s}} \qquad C_s = -K_m + \frac{r_{max} C_s \tau}{C_{so} - C_s}$$

The University of Zambia

School of Agricultural Sciences

Department of Food Science and Technology

2013/2014 End of Year Final Examination

Course: **Food Processing and Packaging (AGF 4300)**

Time Allowed: 3 Hours

Instructions to the candidate

- There are two sections. Each section carries 50%. **Answer Section A and Section B in separate answer booklets**
- Ensure that your computer number is written on the provided answer booklets
- Indicate the questions you have answered in the provided answer booklets
- The use of a certified calculator is permitted

SECTION A (Food Processing Component)

- **Answer question 1 in section A and any other two (2) questions**
- Question 1 is worth 20%, while the other two (2) are 15% each

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1. A conveyer drier is required to dry peas from an initial moisture content of 78% to 16% moisture (wet-weight basis), in a bed 10 cm deep which has voidage of 0.4. Air at 85°C with a relative humidity of 10% is blown perpendicularly through the bed at 0.9 m/s. The drier belt measures 0.75 m wide and 4 m long. The equilibrium moisture content of the peas is 9%, the critical moisture content is 300% (dry-weight basis), the average diameter 6 mm , the bulk density 610 kg/m^3, the latent heat of evaporation 2300 kJ/kg, the saturated water vapour pressure at wet-bulb temperature 61.5 Torr and the mass transfer coefficient 0.015 kg/m^{2}s. Assuming that drying takes place from the entire surface of the peas and there is no shrinkage, calculate:

    a. The drying time in the constant rate period
    b. The energy consumption in the constant rate period

2. A fermenter containing 2.5 m^3 of fermentation medium is to be sterilized. The fermentation is analyzed microbiologically and was found to contain 10^8 CFU/L. The contamination of 10^{-6} CFU/fermenter is permitted. The medium is sterilized according to the following time-temperature program.

Time (sec)	Temperature (°C)	Lethal Values
0	93	
30	95	
60	98	
90	101	
120	103	
150	106	
180	107	
210	108	
240	109	

    a. Using the z-value (6°C) of *Bacillus stearothermophilus* as a reference, complete the column for lethal values
    b. Given the reference organism of *Bacillus stearothermophilus* with a D-value ($D_{121°C}$ = 1.5 min),
        i. Calculate the F-value
        ii. If the fermentation contents are processed at 118°C , calculate the Thermal Death Time (TDT) value and the Lethal rate value?

3. a. Define the following terms:
   i. Emissivity
   ii. Heat flux
   iii. Relative Humidity (RH)
   iv. Absolute Humidity

   b. A fruit Juice is being heated in an indirect heat exchanger using steam as a heating medium. The product flows through the heat exchanger at a rate of 1500 kg/h and the inlet temperature is 20°C. Determine the quantity of steam required to heat the product of 100°C when only latent heat of vapourisation (2200 kJ/kg) is used for heating. The specific heat of the product is 4 kJ/kg°C.

4. a. State the role of each of the following in a mechanical refrigerator:

      i. Compressor
      ii. Expansion valve

   b. Define the following terms:
      i. Cooling load
      ii. Latent heat of crystallisation

   c. Differentiate chilling from freezing

   d. There is a refrigerant flowing at 0.2 kg/s at a temperature of -130°C and enthalpy of 190 kJ/kg. This refrigerant is passed through an evaporator and is superheated to 220°C before compression. It is then compressed to 4 bars of pressure. The condensation results in a subcooling to -10°C.

      i. Calculate the work done (q_w) on the refrigerant during isoentropic compression
      ii. Calculate the rate of heat (q_c) exchanged in the condenser and the rate at which heat (q_e) is accepted by the refrigerant in the evaporator
      iii. Calculate the coefficient of performance (C.O.P)

SECTION B (FOOD PACKAGING)

There are three (3) questions in this section. Answer all questions.

1. What are the considerations needed for selecting an appropriate package? Additionally describe the packaging requirements for potato chips. **(20 Marks)**

2. In kinetics of food quality, how can you tell that the foods shelf life has elapsed? With a table show the 5 attributes and the undesirable changes that may occur.**(20 Marks)**

3. According to (FDA) food laws list and describe 10 situations when food is considered adulterated. **(10 Marks)**

FORMULAE

$$Q = \frac{T_1 - T_3}{\left(\frac{r_2 - r_1}{KA_{lm}}\right) + \left(\frac{r_3 - r_2}{KA_{lm}}\right)}$$

$$T_1 - T_2 = \frac{-Q}{\left(\frac{\Delta X_a}{AK_a}\right) + \left(\frac{\Delta X_b}{AK_b}\right) + \left(\frac{\Delta X_c}{AK_c}\right)}$$

$$Q = \frac{2\pi lK(T_i - T_O)}{\ln \frac{r_o}{r_i}}$$

$$Q = \frac{KA(T_1 - T_2)}{(X_2 - X_1)}$$

$$X = \frac{m_v}{m_a}$$

$$\varphi = \frac{P_v}{P''_v}$$

$$\frac{\Delta T_2}{Q} = [(T_{h2} - T_{c2}) - (T_{h1} - T_{c1})]/Q$$

$$Q = hA(T_p \quad T_\infty)$$

$$Q = A\sigma\varepsilon T_a^4$$

$$-m_c = K_g A(H_s - H_a)$$

$$Q = h_s A(\theta_a - \theta_s)$$

$$-m_c = K_g A(H_s - H_a)$$

$$-m_c = \frac{h_c A}{\lambda}(\theta_a - \theta_s)$$

$$t = \frac{\rho\lambda x(M_i - M_C)}{h_c(\theta_a - \theta_s)}$$

$$h_c = 14.3G^{0.8}$$

$$h_c = 24.2G^{0.37}$$

$$\text{volume of sphere} = \frac{4}{3}\pi r^3$$

$$F = D\,(\log n_1 - \log n_2)$$

$$TDT = 10^{(121 - \Theta)/Z}$$

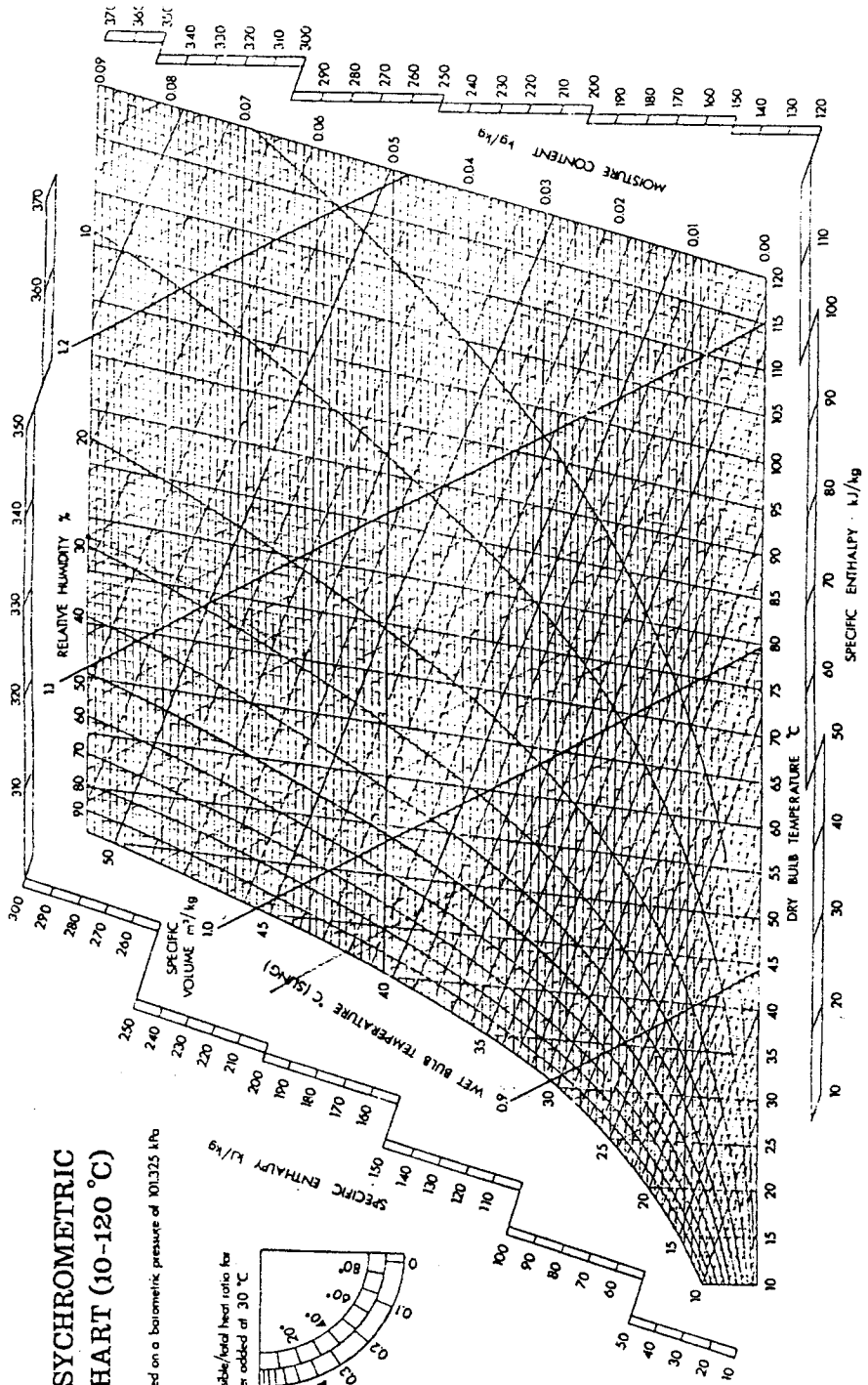


Fig. 14.1 — Psychrometric chart (10–120) °C based on barometric pressure of 101.325 kPa.
(Courtesy of Chartered Institution of Building Services Engineers.)

Table 2.3

Lethal rates for different temperatures T per time unit (min) calculated for a reference temperature of 120°C

T (in °C)	*Bacillus stearothermophilus* (Z=6°C)	*Clostridium botulinum* (Z=10°C)
95	0,000	0,003
96	0,000	0,004
97	0,000	0,005
98	0,000	0,006
99	0,000	0,008
100	0,000	0,010
101	0,000	0,012
102	0,001	0,016
103	0,001	0,020
104	0,002	0,025
105	0,002	0,032
106	0,005	0,040
107	0,007	0,051
108	0,010	0,063
109	0,015	0,079
110	0,022	0,100
111	0,032	0,126
112	0,046	0,159
113	0,068	0,200
114	0,100	0,251
115	0,147	0,316
116	0,215	0,398
117	0,316	0,501
118	0,464	0,631
119	0,681	0,794
120	1,000	1,000
121	1,468	1,259
122	2,154	1,585
123	3,162	1,995
124	4,642	2,512
125	6,813	3,162
126	10,000	3,981
127	14,680	5,012
128	21,540	6,310
129	31,620	7,943
130	46,420	10,000

TABLE A.4.2
Properties of Saturated Steam

Temperature (°C)	Vapor pressure (kPa)	Specific volume (m^3/kg)		Enthalpy (kJ/kg)		Entropy (kJ/kg · K)	
		Liquid	Saturated vapor	Liquid (H_ℓ)	Saturated vapor (H_v)	Liquid	Saturated vapor
0.01	0.6113	0.0010002	206.136	0.00	2501.4	0.0000	9.1562
3	0.7577	0.0010001	168.132	12.57	2506.9	0.0457	9.0773
6	0.9349	0.0010001	137.734	25.20	2512.4	0.0912	9.0003
9	1.1477	0.0010003	113.386	37.80	2517.9	0.1362	8.9253
12	1.4022	0.0010005	93.784	50.41	2523.4	0.1806	8.8524
15	1.7051	0.0010009	77.926	62.99	2528.9	0.2245	8.7814
18	2.0640	0.0010014	65.038	75.58	2534.4	0.2679	8.7123
21	2.487	0.0010020	54.514	88.14	2539.9	0.3109	8.6450
24	2.985	0.0010027	45.883	100.70	2545.4	0.3534	8.5794
27	3.567	0.0010035	38.774	113.25	2550.8	0.3954	8.5156
30	4.246	0.0010043	32.894	125.79	2556.3	0.4369	8.4533
33	5.034	0.0010053	28.011	138.33	2561.7	0.4781	8.3927
36	5.947	0.0010063	23.940	150.86	2567.1	0.5188	8.3336
40	7.384	0.0010078	19.523	167.57	2574.3	0.5725	8.2570
45	9.593	0.0010099	15.258	188.45	2583.2	0.6387	8.1648
50	12.349	0.0010121	12.032	209.33	2592.1	0.7038	8.0763
55	15.758	0.0010146	9.568	230.23	2600.9	0.7679	7.9913
60	19.940	0.0010172	7.671	251.13	2609.6	0.8312	7.9096
65	25.03	0.0010199	6.197	272.06	2618.3	0.8935	7.8310
70	31.19	0.0010228	5.042	292.98	2626.8	0.9549	7.7553
75	38.58	0.0010259	4.131	313.93	2635.3	1.0155	7.6824
80	47.39	0.0010291	3.407	334.91	2643.7	1.0753	7.6122
85	57.83	0.0010325	2.828	355.90	2651.9	1.1343	7.5445
90	70.14	0.0010360	2.361	376.92	2660.1	1.1925	7.4791
95	84.55	0.0010397	1.9819	397.96	2668.1	1.2500	7.4159
100	101.35	0.0010435	1.6729	419.04	2676.1	1.3069	7.3549
105	120.82	0.0010475	1.4194	440.15	2683.8	1.3630	7.2958
110	143.27	0.0010516	1.2102	461.30	2691.5	1.4185	7.2387
115	169.06	0.0010559	1.0366	482.48	2699.0	1.4734	7.1833
120	198.53	0.0010603	0.8919	503.71	2706.3	1.5276	7.1296
125	232.1	0.0010649	0.7706	524.99	2713.5	1.5813	7.0775
130	270.1	0.0010697	0.6685	546.31	2720.5	1.6344	7.0269
135	313.0	0.0010746	0.5822	567.69	2727.3	1.6870	6.9777
140	316.3	0.0010797	0.5089	589.13	2733.9	1.7391	6.9299
145	415.4	0.0010850	0.4463	610.63	2740.3	1.7907	6.8833
150	475.8	0.0010905	0.3928	632.20	2746.5	1.8418	6.8379
155	543.1	0.0010961	0.3468	653.84	2752.4	1.8925	6.7935
160	617.8	0.0011020	0.3071	675.55	2758.1	1.9427	6.7502
165	700.5	0.0011080	0.2727	697.34	2763.5	1.9925	6.7078
170	791.7	0.0011143	0.2428	719.21	2768.7	2.0419	6.6663
175	892.0	0.0011207	0.2168	741.17	2773.6	2.0909	6.6256
180	1002.1	0.0011274	0.19405	763.22	2778.2	2.1396	6.5857
190	1254.4	0.0011414	0.15654	807.62	2786.4	2.2359	6.5079
200	1553.8	0.0011565	0.12736	852.45	2793.2	2.3309	6.4323
225	2548	0.0011992	0.07849	966.78	2803.3	2.5639	6.2503
250	3973	0.0012512	0.05013	1085.36	2801.5	2.7927	6.0730
275	5942	0.0013168	0.03279	1210.07	2785.0	3.0208	5.8938
300	8581	0.0010436	0.02167	1344.0	2749.0	3.2534	5.7045

Source: Abridged from Keenan *et al.* (1969). Copyright © 1969 by John Wiley and Sons. Reprinted by permission of John Wiley and Sons, Inc.

A.6 Pressure–Enthalpy Data

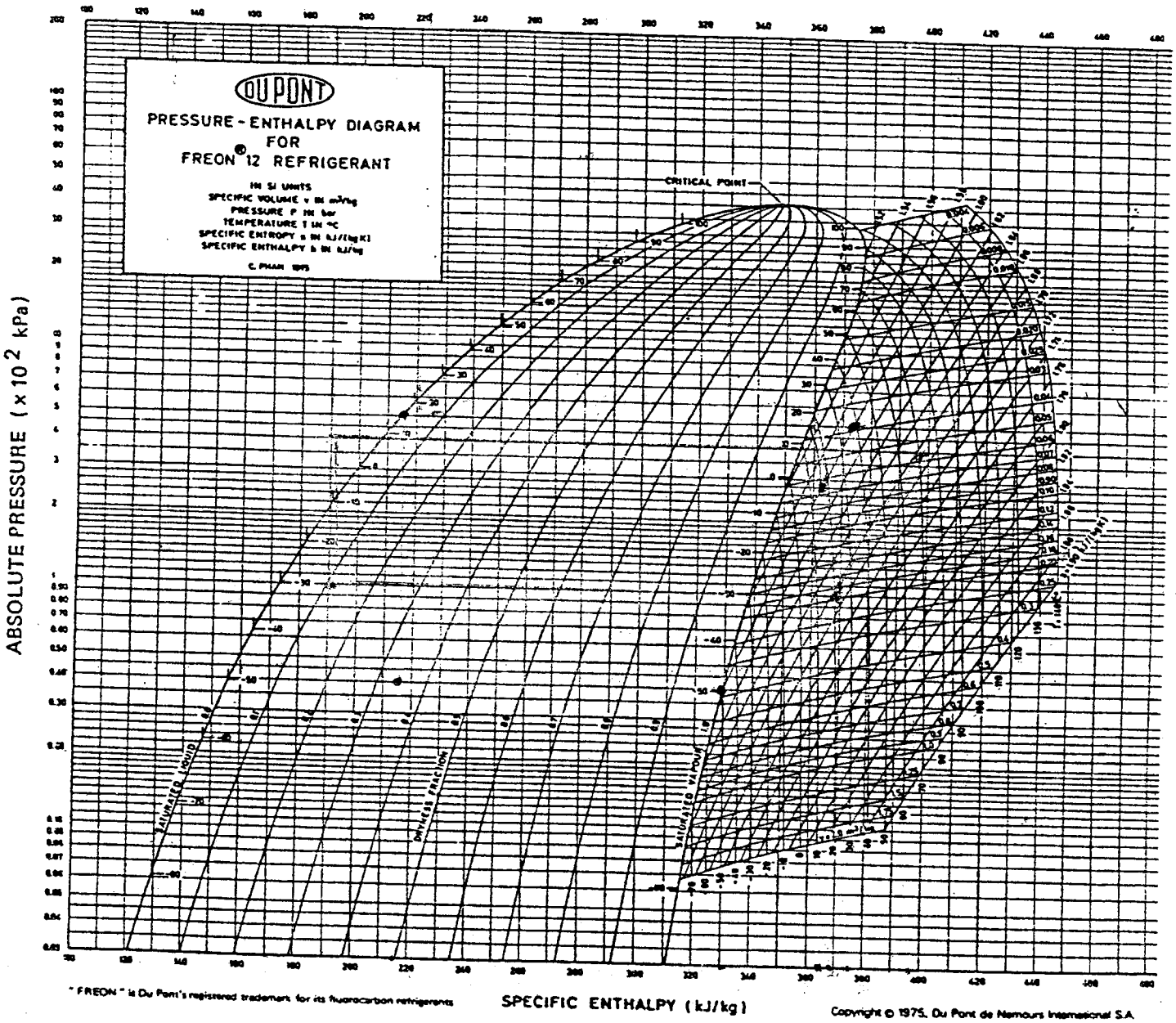
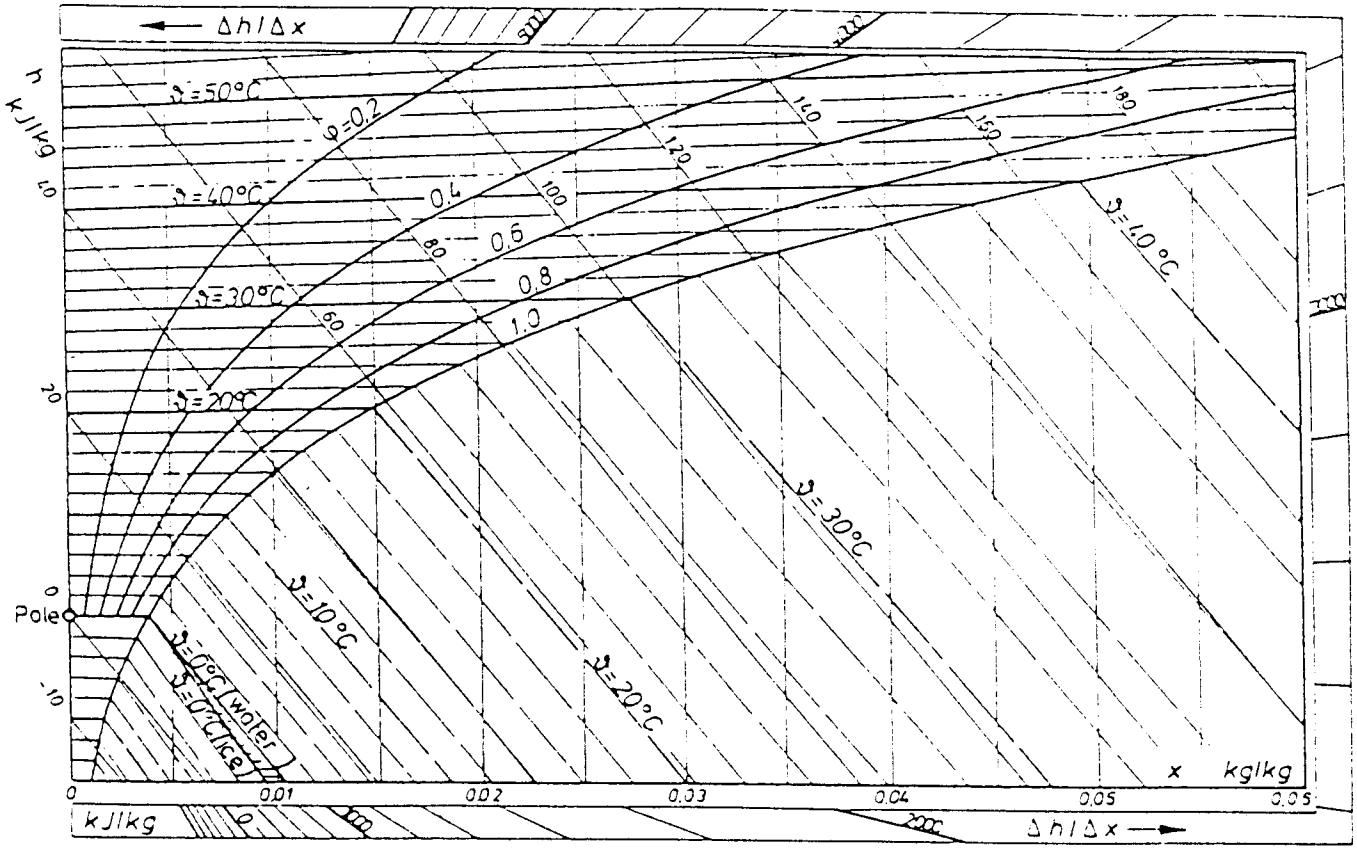


Fig. A.6.1 Pressure–enthalpy diagram for Refrigerant 12. [Reproduced by permission of Du Pont de Nemours International S.A. (Full-sized copies of diagrams for Freon 12 and other refrigerants, suitable for tracing, may be obtained from Du Pont de Nemours International S.A., 9, Route des Jeunes, CH-1211 Geneva 24, Switzerland.)]

Fig. 2.2
h, x-diagram for humid air according to Mollier



The University of Zambia

School of Agricultural Sciences

Department of Food Science and Technology

2013/2014 Academic Year - Final Examinations

Course: Water and Food Waste Management **(AGF 4422)**

Time Allowed: 3 Hours

INSTRUCTIONS

ANSWER ALL QUESTIONS

ALL QUESTIONS CARRY 20 MARKS EACH

1. Describe in detail what is involved in biological treatment of gases? What has prompted the interest in the treatment of gases? **(20 Marks)**

2. What are the benefits of genetically modified organisms in general? Specifically what role do they play in water treatment and waste management. **(20 Marks)**

3. Describe the functions of a trickling filter, design and microorganisms associated with them and possible problems encountered with their use. **(20 Marks)**

4. Mention and describe the drinking water sources and how is water from these sources treated **(20 Marks)**

5. Define the following **(20 marks) (5 Marks each)**
   (a) Ponding
   (b) Sloughing off
   (c) BOD
   (d) Biological Scrubber

.....*END*.....

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013 / 4 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

AGF 511 – Unit Operations in Food Engineering II

Instructions
Answer a total of **five (5)** questions from this paper
Answer any **three (3)** from section 1and answer **both questions** in section 2 and the fifth from either section.
Answer **sections 1 and 2 in separate booklets.**

Time allowed: Three (3) Hours

SECTION 1: Answer any three (3) questions from this section

1. A distillation unit was assembled to handle a feed of 100 kg mol / h containing 45 mol % X and 55 mol % Y. The feed enters at a temperature of 327.6 K. A distillate containing 95 mol % X and 5 mol % Y and a bottoms product containing 10 mol % X and 90 mol % Y is expected to be obtained. The reflux ratio is 4: 1. The average heat capacity of the feed is 159 KJ / kg mol. K and its boiling point is 366.7 K, and the average latent heat is 32099 KJ / kg mol. **Table 1** shows the data for the equilibrium line. Answer the following questions based on this question:

Table 1: Data for equilibrium line for distillation unit

x_A	0	0.130	0.258	0.411	0.581	0.78	1.0
y_A	0	0.261	0.456	0.632	0.777	0.90	1.0

a. Calculate the minimum reflux ratio, R_{min} (**6 marks**)
b. Find the minimum number of theoretical plates in this tower (**4 marks**)
c. Discuss the five (5) main components of a distillation column and then draw a diagram showing all these parts (**10 marks**)

2. Assume a hypothetical, multi-stage extraction counter-current extraction unit with the following stages: 1, 2, n and Nth stages, is mounted. Also assume that the underflow currents are L while the overflow currents are V.

a. Draw a scheme of all the stages and label all the stages, the underflow and overflow currents at each stage (**4 marks**).

b. Write an overall material balance on all stages (**2 marks**).

c. Assuming that there are two components, A and C, in the streams, make overall component balances over the stages associated with A and C (**2 marks**).

d. Describe two (2) main classes or vessels of solvent extraction equipments (**4 marks**)

e. Describe an industrial application of solid - liquid extraction or leaching (**8 marks**)

3. An oil solution was tainted with a yellow-greenish colour that was identified as a pigment from the soybean used for oil extraction. It was suggested that activated carbon be used to remove the pigment from the oil. Equilibrium data of this process is shown in **Table 2** and the removal of the pigments is reported to obey the Freundlich isotherm. Answer the following questions about this process.

Table 2: Equilibrium data given for the removal of pigments from oil sample using activated carbon

a.

c (kg pigment / m^3 oil solution)	q (kg pigment / kg activated carbon)
0.322	0.15
0.117	0.122
0.039	0.094
0.0061	0.059
0.0011	0.045

a. What was the name of the unit process used to remove the pigments (**2 marks**)?

b. At what temperature (freezing / room / boiling/ etc) do you expect that the operation to have been carried out for the most effective (**1 marks**)

c. After the removal of the pigments, it is realized that it would have been costly to throw away the activated carbon. How can the activated carbon be regenerated for future use? (**2 marks**)

d. Draw the appropriate graph associated with the isotherm and determine the equation for this isotherm and derive the values of k and n of the formula associated with the Freundlich isotherm (**15 marks**).

4. Answer the following questions on absorption.
   a. Discuss the process of gas absorption and the two (2) designs of absorption towers. (**10 marks**)
   b. Name and briefly describe three (3) types of trays used in gas absorption. (**10 marks**)

SECTION 2: Answer at least 2 questions in a separate booklet.

1. An evaporator is concentrating *F* kg /h at 311K of a 20 wt % solution of NaOH to 50%. The saturated steam used for heating is at 399.3 K. The pressure in the vapour space of the evaporator is 13.3 kPa. The overall coefficient is 1420W/m^2.K and the area is 82.3m^2. Calculate:
   a. the feed rate *F* of the evaporator **[5 marks]**
   b. the liquid leaving the evaporator **[5 marks]**
   c. the vapor leaving the evaporator **[4 marks]**
   d. Discuss the difference between a forward-feed and backward-feed evaporator with aid of illustrations and give an example of the type product each evaporator is used to process. **[6 marks]**

2. A salt solution with 35% Na_2CO_3 is cooled to 20^oC and crystallizes as a decahydrate. An amount of 5% of the original solution evaporates during cooling. For a yield of 90% $Na_2CO_3.10H_2O$ crystals; Calculate:
   a. the feed solution if the solubility at 20^oC is 21.5kg anhydrous Na_2CO_3/100kg total water. **[10 marks]**
   b. the amount of crystals of $Na_2CO_3.10H_2O$ in kg. **[2 marks]**
   c. Crystallizers are classified according to the method of crystallization. Discuss the difference between the circulating-liquid method and circulating magma method. **[8 marks]**

P.T.O.

Data for the Examination

$F = D + B$

$x_D / R_D + 1$

$R_m / R_m + 1 = (x_D - y') / (x_D - x')$

$R_m = (x_D - y') / (y' - x')$

$q = 1\text{-}f$

$- q / 1\text{-}q$

$$q = \frac{(H_V - H_L) + C_{pL} (T_B - T_F)}{H_V - H_L}$$

$q = kc^n$; Slope = 1/n and intercept = log k

$$q = \frac{q_o c}{k + c}$$; Slope = k/q_o and intercept = $1/q_o$

$\Delta H = mc (T_2 - T_1)$

$\Delta H_s = m_s H_s$ or $\Delta H_s = m_c H_c$

From steam tables

$H_{s,543.1} = 2746.5$ kJ / kg

$H_{c,155} = 627$ kJ / kg

$\lambda = Hs - hs$

$F = L + V$

$Fx_F = Lx_L$

$q = U A \Delta T$

$q = S(Hs-hs)=S\lambda$

$q = (H_2 + Hv) - H_1$

molar weight (g/mol)

Ba =	137.33
N =	14.01
Mg =	24.3
S =	32
H =	1
O =	16

K = 39.1

Cl = 35.45

Na = 23

C = 12

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/4 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

AGF 512 – Technology of Meat and Fish Products

INSTRUCTIONS

Answer **any three (3) questions** in **Section 1** and answer **ALL** questions in **Section 2**

Each question in **Section 1** is allocated marks as **shown in parenthesis**

All questions in carry equal marks (**20 marks each**)

Time allowed: Three (3) hours

SECTION 1: Answer any three (3) questions from this section

1. Explain the concept of colour change in cured meats starting with fresh meat to the final product (Assume that the cured meat is also heat treated) **(20 marks)**
2. Rigor mortis and ageing are two very important changes that occur in meat after slaughter. Describe the changes that occur in these two concepts and distinguish the two (2) concepts from each other. **(20 marks)**
3. Discuss the activities associated with muscle relaxation and stretching in live animals. **(20 marks)**
4. Discuss the concept of reconstituted meat citing the use of two (2) reconstitution agents. Discuss what these agents are, their make-up and the principle on how these agents facilitate the process of reconstitution. **(20 marks)**

SECTION 2: Answer ALL questions in this section

1. Name and describe in detail the non-bacterial post-mortem changes in fish. How do these changes affect fish quality **(20 marks)**

2. (a) What are the three gases used in modified atmosphere packaging, state why they are important in MAP and describe their different roles in fish quality **(10 marks)**

   (b) Describe with appropriate equations the steps involved in bacteriological spoilage of fish **(10 marks)**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/14 ACADEMIC YEAR MID-YEAR FINAL EXAMINATION

AGF 521 - Principles of Food Technology II

Instructions:

This paper has a total of **Seven (7)** questions and you are required to answer a total of **five (5)** questions
Answer **Question one (1) (Compulsory)** and **any other four (4)** questions of your choice. All marks allocated to each question are indicated at the end of each question. Note that some formulae and constants are given on the last page.

Time allowed: **Three (3) Hours**

Question 1 (Compulsory)

You are a Research & Development officer of a food manufacturing firm in Lusaka. The marketing department has identified an aqueous based drink and oily based drink. Investigations have revealed that a blend of these two drinks would produce a highly selling product. A blend ratio of aqueous-to-oily of 7:3 by volume has been found to be sensorially liked by consumers. The drink will also contain food additives.

(a) Propose food additives you would include in the formulation of this aqueous-lipid based drink. **(5 marks)**

(b) Give reason(s) why you are proposing those additives. In your explanation(s), include brief discussions on the stabilization or destabilization factors that each food additive works for or against, respectively. **(10 marks)**

(c) How do you propose to blend the two phases into one blended drink with its food additives (propose a flow-sheet to explain your answer, give reasons for each step in your proposed flow-sheet). **(10 marks)**

(d) Using the principles of colloidal science you have learnt, also state which of the two primary drinks is likely to be the continuous phase and why? **(5 marks)**

Question 2

(a) Write short notes on the following:

i. Marangoni effect

ii. Spreading coefficient of liquid droplets

iii. Zeta potential

iv. Surface Excess Concentration of surfactants

v. Stability ratio of coagulation **(10 marks)**

(b) State three (3) sources of disruptive forces for a droplet during homogenization of a primary emulsion into a secondary emulsion? Out of the three, choose one which you can describe/explain how that disruptive force breaks up the emulsion droplet? **(10 marks)**

Question 3

(a) (i) Define van der waals interactions

(ii) State and briefly explain three types of van der waals forces

(iii)Which of the three types is prominent and why? **(10 marks)**

(b) Colloidal classification can depend on the continuous phase. State three major classes of colloids depending on that classification. Out of the three, pick one and give three sub classes with a typical example of a food for each sub-classs **(10 marks)**

Question 4

(a) Surfactants aggregate spontaneously in solution to form a variety of thermodynamically stable structures known as association colloids. A common example of association colloids is a micelle. Associated with the micelle is the Critical Micelle Concentration (CMC). Explain and discuss the CMC concept including the effects of a surface active compound on the properties of a solution below the CMC, at CMC and above the CMC. **(10 marks)**

(b) A colloidal mill is one of the homogenizers used in the food emulsion industry to produce food emulsions. Explain how the colloidal mill works and state what type of raw material is suitable for the colloidal mill? **(10 marks)**

Question 5

(a) A droplet of corn oil is dispersed in an electrolyte solution of 0.1M of sodium chloride. With the help of defined model(s), explain how the ions will distribute themselves around the droplet and give a reason to your choice of distribution **(10 marks)**

(b) What are viscoelastic materials? In your definition, give an example **(6 marks)**

(c) What is the difference between plastic and viscoelastic materials? **(4 marks)**

Question 6

(a) Calculate the required value of the stability ratio of Intra-lipid emulsions used for parenteral feeding in order to have a half-life of at least 2 years. These commercially available emulsions contain 20 g of purified soybean oil (δ=925 kg/m^3) as well as 1.2 g of purified egg lecithin (δ=1050 kg/m^3) per 100 ml of emulsion. The volume-equivalent particle diameter ϕ_{30} is 220 nm. It may be assumed that all lecithin is adsorbed to the O/W interface. The continuous phase is aqueous **(10 marks)**

(b) A new firm has embarked on producing a salad dressing. During their product development stage, they noted that on letting the salad dressing to stand, creaming was experienced after a period of twenty (20) hours. Their Research & Development (R&D) Manager advised them to include a polysaccharide, **Dextran**, as a stabilizer to stop the creaming. Initially, he advised them to use 0.05% of dextran but still experienced creaming within fifteen (15) hours. After further consultations, the R&D Manager advised them to increase the concentration to 0.25% at which the creaming was completely halted.

(i) Explain the reason for the creaming during the initial stage of product development **(3 marks)**

(ii) Explain the reason for the creaming experienced after addition of 0.05% dextran **(3 marks)**

(iii) Give the possible reason and the phenomenon responsible for stopping the creaming after addition of 0.25% **(4 marks)**

Question 7

(a) Liquid foods can be classified in different ways depending on the rheological behavior. State and explain the classification of liquid foods based on rheology with clear examples and importance of such classification in food processing **(10 marks)**

(b) A potential gradient of 20V/cm was applied across 0.2 mol/ dm^3 NaCl aqueous solution. A spherical particle of 1.0μm diameter was dispersed in this NaCl aqueous solution which was maintained at 25°C. The dispersed particles under these conditions were observed to be in motion and covered a distance of 140μm in 16 seconds. With the assumption that the viscosity of the water at 25°C was 0.89 Pa.s and the value of D was 78.55, estimate the:

(i) electrophoretic mobility of the particle **(3 marks)**

(ii) zeta-potential of the particle **(7 marks)**

End of Exam

(FORMULAE AND CONSTANTS OVERLEAF)

Formulae and constants for examination

$\Gamma = -1/(R*T) * (d\gamma / d\ln C) = -C / R*T * d\gamma / dC$

$\Gamma = -(1/(z^+ + z^-))*1/(R*T)*(d\gamma / d\ln C) = -(1/(z^+ + z^-))*C/(R*T)*(d\gamma / dC)$

$\Sigma = 1 / \Gamma$

$Pa_1 = (1/\Gamma) / N_A = \Sigma / N_A$

$\Delta P_L = 2\gamma / r = -2 * \gamma * \cos\theta / r_c = h * \delta * g$

$(2 * \pi * r_c) * \gamma * \cos\theta = (\pi * r_c^2 * h) * \delta * g$

$$\mu = \frac{\zeta * \varepsilon}{1.5\eta}$$ Debye – Hückel equation

$$\mu = \frac{\zeta * \varepsilon}{\eta}$$ Helmoltz-Smoluchowski equation

$$\mu = \frac{v}{E}$$

$\kappa = \sqrt{(2* Z^2 * F^2 * C_o / \varepsilon RT)}$

$\kappa = \sqrt{(2* Z^2 * e^2 * n_o / \varepsilon kT)}$

$\kappa = 1.04 * 10^8 \sqrt{(C_o * Z^2)}$

$R*T*\ln [P_{vr}/P_{vo}] = 2* \gamma *M/\delta*r = 2*\gamma*V_L / r$

$t_{1/2, slow} = W * t_{1/2, fast}$

$t_{1/2, rapid} = 3*\eta / (4*k*T*N_o) = 2*10^{17}/ N_o$ at 25°C in water

$N_o = fv / [(\pi/6)*\phi^3]$

$F = 96485$ C / Mole

$e = 1.602 * 10^{-19}$ C

$R = 8.314$ J / (mole.K)

$\varepsilon_o = 8.85 * 10^{-12}$ F/m

$k = 1.38 * 10^{-23}$ J/K

$N_A = 6.023 \times 10^{-23}$

δ_{H2O} at 22°C ≈ 1000kg/m3

$g = 9.81$m/s

$\pi = 3.14$

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

2013/14 ACADEMIC YEAR SECOND SEMESTER FINAL EXAMINATION

TECHNOLOGY OF FERMENTED PRODUCTS – AGF 522
TIME: THREE (3) HOURS

INSTRUCTIONS

Answer **all questions**.
All questions carry equal marks.

---

1. Acid-based food fermentation involves the use of different species of lactic acid bacteria (LAB).
   a. Discuss the difference between Homo and Hetero-fermentative lactic acid bacteria and give two examples for each. **(7 marks)**
   b. Explain the microbial evolution during sauerkraut fermentation process. **(10 marks)**
   c. Vicky Tech Foods Limited approaches you with a problem of bloating in their natural cucumber pickling process. Explain the possible causes and offer possible solutions to this problem. **(8 marks)**

2. Oriental fermented food products are popular and important for flavor enhancement as well as being good meat substitutes.
   a) Explain the manufacturing process with aid of a flow diagram of Tempeh. **(10 marks)**
   b) Explain how Natto differs from Tempeh. **(5 marks)**
   c) Discuss the similarities and differences of the koji and malting process. **(10 marks)**

3.

a. Describe the role of microorganisms in the kefir grains during kefir making. **(10 marks)**

b. Mate Dairy Products Limited produces yoghurt using a portion of each previous batch as starter culture for the next. The manager approaches you with a problem of the yogurt becoming sourer with each successive batch. Diagnose the problem and offer possible solutions. **(10 marks)**

c. Name the aroma compounds in yoghurt and elucidate how it is produced giving the bacteria involved. **(5 marks)**

4. Gaspard Investments Limited would like to invest in the wine industry and has accepted your bid to be their consultant for the establishment of a fruit wine manufacturing factory. The Board invites you to make a presentation on:

a. the mango wine making process since grapes cannot grow well in that area. **(15 marks)**

b. Explain the role of hops in the beer making process. **(5 marks)**

c. Describe the influence of water on the quality of beer. **(5 marks)**

End of Examination

GOOD LUCK!!!!!

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013/4 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

AGF 531 – Technology of Plant products and Beverages

INSTRUCTIONS

Answer **ALL** questions in **Section 1** and answer any **three (3)** questions in **Section 2**

Each question in **Section 1** is allocated marks as **shown in parenthesis**

All questions in **Section 2** carry equal marks (**20 marks each**)

Time allowed: Three (3) Hours

SECTION 1

1. During the formulation of HFCS, _____ activates the enzyme α-amylase while _____ activates glucose isomerase (**2 marks**).
2. Distinguish the terms gelatinization and retrogradation (**4 marks**)
3. A bakery product has the following ingredients: 100 % Flour, 66 % water, 2 % salt, 8 % sucrose. Using baker's percentages, calculate how much sugar is needed if we start with a batch of 235 g of flour (**2 marks**).
4. What are the roles of sulphur dioxide in wet milling processes? (**4 marks**)
5. **True / False:** Fermenting a green pigmented white / Irish potato will detoxify the solanine compounds in it (**1 mark**).
6. This grain (_____) has the second highest caloric content after oats but also has the lowest protein content (**1 mark**).
7. Briefly discuss two (2) advantages and one (1) disadvantage of dry milling (**6 marks**).
8. What is the role of an entoleter in cleaning of grain? (**2 marks**)

9. Chlorine is used in the treatment of wheat flour. However, it has both advantages and disadvantages in the final quality of flour. Briefly elaborate on this statement (**5 marks**).
10. What is the reason for the decrease in viscosity during the 1 hour of starch cooking at 95°C in an RVA? (**2 marks**)
11. Briefly explain how miraculin works as a natural sweetener? (**2 marks**)
12. A client from a food company wants you to find them a supplier of tapioca starch. What raw product is used to produce this type of starch? (**2 marks**)
13. Calcium propionate is added to _____ to prevent _____ _____ (**2 marks**).
14. In what type of product does ammonium carbonate have limited usage as a chemical leavening agent and why? (**3 marks**)
15. Farina is an option to semolina but it has limitations in producing the consumers' desired end product because it lacks _____ and therefore produces a _____ pasta product (**2 marks**).

P.T.O

SECTION 2: Answer any three (3) questions in this section

1. Dry milling of maize and wheat have numerous similarities although they also have some differences. Outline and briefly discuss three (3) differences: one related to a preparatory process(es), another related to the use of a given equipment and also another related to the end-products obtained (**20 marks**).

2. Mutinta works in a cereal laboratory and her advisor gave her a white powdery sample to analyse and he told her that it was not toxic. The powder tasted bland (tasteless). She then decided to use iodine solution to determine what it was because she thought it may be a starch sample. The iodine turned dark blue and she got excited about it. She also went on to make a smear by taking a small amount of the flour and mixing it with water on a glass slide and observed it under a polarising microscope.

a. Explain scientifically how the dark blue reaction occurs (**3 marks**).

b. What does the Iodine test reveal about the constituent(s) of this sample? (**2 marks**)

c. Draw the structure of the chemical that could have been responsible for this dark blue colour change (**6 marks**)

d. How does this chemical differ from the one that could have caused an alternative colour change? Draw the other structure. (**7 marks**)

e. Mutinta's observation on the slide validated her decision that this was truly a starch sample. What do you think she saw under the microscope to be a 100% sure that this was starch? (**2 marks**)

P.T.O.

3. You work for National Milling in Zambia and you recently acquired a new supplier of wheat flour. The owner is very excited about the prospects of this new flour and mentions that this is a strong flour which will be very good for making bread. You know that even if he is so enthusiastic about his product, you will need to confirm his claims. You have a soft flour in your laboratory and you plan to use it as a control in your tests. His flour will also be called the unknown flour.

a. What proximate test will you carry out to determine whether his claims are true or false? Name a method (or methodology) with which will you make this analysis? (**3 marks**)

b. How do you expect the proximate test result of the unknown flour compare to your control (give expected approximate values)? (**4 marks**)

c. You have a piece of equipment in your laboratory that you can use to further validate your client's claims. This equipment can give you different information that can be used to confirm the validity of his claims.

i. Name this equipment (**2 marks**).

ii. Name **four (4)** additional information that can be obtained from this equipment (**4 marks**).

iii. This equipment generates graphs that can be used to make various interpretations. Make simple sketches of graphs that could represent your unknown flour and control (show how these graphs compare to each other (assuming that your client's claims are actually true)). Label the four (4) points or regions that you identified in **c.ii** (**5 marks**).

iv. How would you expect the water contents derived from the equipment compare with each other (i.e. for the unknown and control flours)? (**2 marks**)

P.T.O

4. An entrepreneur has decided to embark on a project. She heard and read somewhere that molasses have some amount of soluble sugar (~30 to 40% sucrose and 20% invert sugar) and that Nakambala Sugar Estates is throwing away molasses. She wants to start a business where she will recover the remaining sucrose from molasses.

a. What stage of sugar processing do molasses come from? (**2 marks**)

b. Other than sucrose and invert sugar, name three (3) other components or compounds that are present in molasses (**6 marks**).

c. You are assigned as an advisor to this lady, would you advise her whether this would be a worthwhile project or not. Support your answer with reasons. (**6 marks**)

d. From your knowledge of the course, what other plant product(s) would you use to extract sucrose in the same manner as sugar cane? (**2 marks**)

e. Give two (2) areas where molasses are currently used (**4 marks**).

THE END

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

2013/14 ACADEMIC YEAR MID-YEAR FINAL EXAMINATION

AGF 541 – Technology of Dairy and Egg Products

Instructions: Answer **Five (5)** questions; answer **all questions from section one** and **two (2)** from **section two**.
Answer the **two sections in separate booklets**.
Marks allocated for each question are indicated at the end the questions

Time allowed: Three (3) Hours

SECTION 1: Technology of Dairy Products

1. Butter is a milk fat rich product that is widely consumed.
   a. Explain with aid of an illustration, the butter manufacturing process.
   [16 marks]
   b. A butter manufacturer approaches you with a problem of the churning process taking too long and giving low yields of butter. Explain the possible causes.
   [4 marks]

2. GVM Dairy Products is involved in the manufacture of Reconstituted Long Life Milk. The company Technical Manager approaches you with a problem of the packs bulging after 7 days. Explain:
   a. the possible causes highlighting the different tests and checks you would carry out on the product and production line. **[8 marks]**
   b. the possible solutions and make recommendations that will prevent the problem from recurring. **[5 marks]**
   c. how UHT milk differs from pasteurized and sterilized milk. **[7marks]**

3.
   a. Explain the principle of homogenization and its effects on the quality and yield of cheese. **[5 marks]**
   b. Show the milk powder manufacturing process using a flow diagram. **[6 marks]**
   c. Describe the symbiotic relationship of the yoghurt cultures. **[6 marks]**
   d. Explain the importance of the aging process in ice-cream making. **[3 marks]**

SECTION 2: Technology of Eggs – Answer **all** questions in a **separate booklet.**

1. Eggs are a highly perishable commodity therefore, they have to be treated in a way that can allow their use over a long period of time. Describe all possible external ways of maintaining whole egg quality. In the same vein describe in detail all possible ways of maintaining the quality of eggs removed from the shell and link the eggs removed from the shell to appropriate food industries and specific industrial applications.

[20 marks]

2. (a) Egg production is an integral part of the reproductive cycle in poultry, with an appropriate diagram expand on this statement, describing the sequence of events and possible defects that may occur during egg formation. **[15 marks]**

   (b) Briefly describe the composition of eggs and its importance to human nutrition.

[5 marks]

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

2014 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 6000.

   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 +.....+ 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 the grain silo aeration system at the maize milling plant, the hygrometer measured the temperature and the relative humidity of air expelled from the grains to be 30 °C and 42% respectively. The flowrate and density of the incoming ambient air was reported to be 0.001 $m^3.s^{-1}$ and 1.2 $kg.m^{-3}$ while the temperature and relative humidity were 10 °C and 65% respectively
   a) Assuming there is no latent heat production by the grains; calculate the rate of moisture removal from the grain bulk during aeration. **[15 points]**
   b) Cooling with dehumidification is one of the ways of air conditioning that can be done to bring about the desired temperature and humidity levels. Describe this process. **(5 points)**
   c) What happens to the dry bulb temperature and relative humidity of the air if the cooling process is done at a constant absolute humidity? **(5 points)**

3. During the usual design process of a food processing plant, there are several types of flow sheets that are developed from the initial preliminary assessment of a project to the construction and start up phase.
   a) Describe in your own words two of these flow sheets that may be of significant to you. **(7.5 points)**
   b) Isolation and shutoff valves are usually included on the process flow sheet. TRUE/FALSE **(5.5 points)**
   c) With regard to plant layout, describe briefly six principal factors that will ensure economic construction and efficient operation of the process units. **(6 points)**
   d) Deciding where to locate the food processing plant maybe a difficult decision for an investor to make. Mention three ways by which the Zambian government may help to direct new investment to new locations other than Lusaka; such as areas of high unemployment like Mongu. **(6 points)**

4. 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. **(6 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** specifications that he may look for from the vendors of this equipment. **(4 points)**

d) Do a brief competitor analysis for the fruit juice processing business in Lusaka. **(6 points)**

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2013/14 ACADEMIC YEAR - FINAL EXAMINATION

AGF 5432 – Food Safety and Quality Management

Instructions:

There are two (2) sections in this examination paper. The answers to the two sections should be in two separate booklets. Clearly label each booklet as Section A and Section B. The marks allocated to each question are indicated at the end of each question.

SECTION A has two (2) questions. **Answer both questions.**

SECTION B has four (4) questions. **Question one (1) is compulsory** and then, answer **any other two (2)** questions of your choice out of the remaining three questions.

Time allowed: **Three (3) Hours**

SECTION A

QUESTION 1

a) Briefly explain the seven (7) principles of Hazard Analysis and Critical Control Point (HACCP). ***[14 marks]***

b) Hazard Analysis and Critical Control Point (HACCP) is a system which identifies, evaluates, and controls hazards which are significant for food safety. Mrs. Mulenga is a food Safety Manager in a food processing company and would like to implement a HACCP system and needs your advice on how to implement HACCP systems. Give an outline of the steps that she needs to follow in order to implements an effective HACCP system. ***[11 marks]***

QUESTION 2

a) According to ISO 9001 Quality Management System, eight (8) quality management principles have been identified that can be used by top management in order to lead an organisation towards improved performance. Briefly explain each of the 8 principles of food quality management systems according to ISO 9001-Quality Management Systems. ***[18 marks]***

b) Mr Banda is an entrepreneur who processes milk products in his dairy processing company. He would like to implement management system(s) that will assure customers that his products will be consistently of the required quality and safety. Which management system(s) would you advices Mr Banda to implement and why would you advise him to implement such a system or systems. ***[7 marks]***

SECTION B

QUESTION 1 (COMPULSORY QUESTION)

There has been many food safety crises around the world especially among the so called industrialized world more than in the developing countries. This entails that the developing countries have good food safety systems in place. With the various food safety concepts you have learnt from the course, with clearly outlined points, argue your case for or against this statement. ***[20 marks]***

CHOOSE ANY TWO (2) QUESTIONS FROM QUESTIONS 2 TO 4.

QUESTION 2

(a) In not more than five sentences, define the following terms in food safety and quality management field:

(i) Food safety ***[2 marks]***
(ii) Microbiological criteria ***[2 marks]***
(iii)Regionalization in SPS Agreement ***[2 marks]***
(iv)ARfD ***[2 marks]***
(v) Risk analysis ***[2 marks]***

(b) In the framework of international food safety systems, there are three (3) major standard setting bodies in relation to international food safety systems. State the three major standard setting bodies and briefly discuss their roles in relation to food safety and, international trade of agricultural and food products. ***[10 marks]***

QUESTION 3

Explain the "farm-to-fork" concept and discuss its importance to food safety ***[20 marks]***

QUESTION 4

Outline the legislative structure of the Zambian food safety system, with emphasis on the major Acts, at least six (6) and how they relate to the food safety system in Zambia ***[20 marks]***

.....END.....

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES AGRICULTURAL ECONOMICS & EXTENSION

2014 MID TERM FINAL EXAMINATION

AG6 3811: RURAL SOCIOLOGY

DATE: 05/03/14 **TOTAL MARKS: 100**

TIME: THREE HOURS

INSTRUCTION: ANSWER ALL QUESTIONS IN SECTION A AND ANY FOUR QUESTIONS IN SECTION B.

Section One

(Multiple choice. Answer all. Each question carries two marks)

1. All but one of the following are included in the concept of culture:
   a) Biological heredity,
   b) Beliefs,
   c) Laws and customs,
   d) Language

2. Which of the following does not qualify as a science?
   a) Philosophy,
   b) Economics,
   c) Sociology,
   d) Anthropology

3. A society which is receptive to change is likely to:
   a) Stress the observance of rituals,
   b) Be critical of some aspect of its traditions,
   c) Honor the wisdom of elders,
   d) Both b and c above

4. Modernization theory argues that:
   a) Anti-social behavior is important to progress,
   b) Casual life is at the root of human progress,
   c) Fate is important in human progress,

d) Progress depends on human ability to control their own destiny

5. To sociologists the most important human trait of greatest importance is:
   a) Human nature,
   b) Intelligence,
   c) Aggression,
   d) Individualism

6. Among the difficulties handicapping the scientific observer of human behavior is:

   a) The inability to conduct experiments,
   b) Unconscious bias,
   c) The vested interests of those concerned about what is being observed,
   d) All but a above

7. The spread of cultural traits from one group to another is called:
   a) Distribution,
   b) Diffusion,
   c) Extension,
   d) Succession

8. To be a successful agent of change, one must:
   a) Learn about the cultural pattern where he or she is trying to induce change,
   b) Be prepared to run the risk of punishment,
   c) Try to associate the innovation with some aspect of the society which is already cherished,
   d) All the above

9. In a complex, changing society:
   a) Sex and age roles are fairly well defined,
   b) A wide choice of achieved positions provides a sense of freedom, personal worth, and security,
   c) The choice of achieved positions and the development of new ones brings confusion and anxiety,
   d) Both a and c above

10. Most sociologists agree that with respect to values:
    a) They should repress them,
    b) They can do research showing the relations between values,
    c) They have a right to express their values as citizens,

d) Both b and c above

Section Two

(Essay type. Answer any FOUR questions. Each question carries 20 Marks)

1. Using Karl Marx's Theory
   a) State the theory, briefly discussing the major achievements recognized in sociology to date (10 marks).
   b) Clearly explain the counter argument of Max Weber to Karl Marx's theory (6marks).
   c) Distinguish between the concept Sociology and rural sociology (4 marks).

2. "Stratum consciousness, common experiences, social mobility and ideology constitute four ~~three~~ fundamental characteristics of stratification." With practical examples, describe each one of these characteristics (20 marks).

3. How do you contrast following paired terminologies?
   a) Affectivity and Affective neutrality variables(4 marks)
   b) Objectivity and Subjectivity socialization (4 marks)
   c) Preparatory and Play development stages (4 marks)
   d) Reward and Expert power (4 marks)
   e) Status-based societies and contract- based societies (4 marks).

4. "A family as an institution is said to inculcate its members"
   a) Define the term institution (4 marks)
   b) Explain three major functions of the family (12 marks)
   c) State at least two known cultural threats that current environment pose on the Zambian families (4 marks)

5. In the light of your knowledge on "leadership styles", how might an understanding of gender strengthen sex differences in leadership behaviors? (20 marks).

.....END EXAMINATION.....

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES AGRICULTURAL

DEPARTMENT OF ECONOMICS AND EXTENSION

2014 ACADEMIC YEAR FINAL EXAMINATION

AGG3822: AGRICULTURAL EXTENSION

TIME: THREE (3) HOURS

TOTAL MARKS: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS. EACH QUESTION CARRIES EQUAL MARKS

QUESTIONS

1. Explain the term extension training method and based on two classified methods discuss its associated merits and demerits (20 marks).

2. "The success or failure of extension organization depends solely on how it is organized" Chronologically, discuss management functions essential for the design and operational efficiency of an organization (20 marks).

3. State major differences between Integrated Rural Development Programmes and Commodity Development Approach suggesting improved ways to assisting farming communities in Zambia (20 marks).

4. Define the term diffusion and state the major roles the three elements play in the diffusion of innovation process (20 marks).

5. With aid of a diagram, clearly interpret the major segments in the S-M-C-R model and the aspects it helps us understand (20 marks).

..... END.....

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2014 END OF YEARB EXAMINATIONS

COURSE : **AGG 3832 FORAGE CROP PRODUCTION AND RANGE MANAGEMENT**

DATE : **FRIDAY 25TH JULY 2014 14:00 HOURS**

DURATION : **3 HOURS**

INSTRUCTIONS : **ANSWER ANY FIVE QUESTIONS**

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1. Natural pastures are the cheapest and main source of feed for the ruminant livestock population in Zambia. However the quality and quaintly of pastures is not uniform throughout the year posing a serious challenge to proper ruminant nutrition.
   a) With the aid of a graph show the pattern of pasture availability in grazing areas in Zambia throughout the year (6 marks).
   b) Indicate which time of the year farmers face a lot challenges in feeding their animals and how these challenges be addressed? (6 marks).
   c). Bush encroachment is another problem that affect pasture productivity in grazing areas. What are the causes of bush encroachment in grazing areas) 4 marks).
   d). What methods can be used to control bushes in grazing areas.(4 marks).

2. Hay is the oldest, and still the most important, conserved fodder, despite its dependence on suitable weather at harvest time. Meeting the feed requirements of each class of cattle is important in producing productive and healthy livestock. To do this, you need to understand both the feed requirements of your cattle as well as the value of the available feed.
   a) List down the important steps involved in the production of good quality hay (6 marks).
   b) What are the characteristics of good quality hay (9 marks).
   c) How would you enhance the hay before feeding the animals (5 marks).

3. Rangeland degradation consists of a reduction in the quantity or nutritional quality of the vegetation available for grazing. The prospect of increased rangeland degradation

is common to all dryland areas. In particular, the deterioration is more advanced in semi-arid and sub-humid areas than in arid areas.

a) What are the characteristics of these range lands? (4 marks).
b) Outline the importance of rangelands in Zambia (6 marks).
c) What are the causes of rangeland degradation in Zambia? (4 marks)
d) What measures should be carried out to improve the productivity of rangelands in Zambia? (6 marks).

4. a) Define an ecosystem (3 marks).
   b). What are the components of an ecosystem in rangelands (6 marks).
   c) Draw a diagram to show energy flow in an ecosystem (6 marks).
   d) What are ecosystem goods and services. Explain and give examples (5 marks).

5. In range management it is important to carry out a natural resource inventory
   a) In natural resource inventory mention the six types of plant attributes that are commonly measured. (6 marks).
   b) The following data of two desirable browse species Moringa and Leucaena was collected from 12 quadrants from grazing area in Central Province. Each quadrant was 10 meters x 10 meters

Quadrant No.	1	2	3	4	5	6	7	8	9	10	11	12
Number of moringa plants	2	0	5	3	11	0	1	12	0	3	9	4
Number of Leucaena plants	3	1	1	0	0	0	2	0	0	1	0	1

   i) Calculate
   The frequency of moringa and of Leucaena
   The density per hectare of moringa plant and of Leucaena (10 marks).
   ii) Which of the two has better results in terms of frequency and density (4 marks).

6. Mr Likando a recently retired officer bought 120 hectares farm and wants to venture into beef production. He wants to start by buying heifers and he has reserved 80 hectares for the heifers.

   a) Determine the number of 275kg heifers a 80-hectare pasture will support for 365 days, given a pasture yield of 4,000kg of dry matter per hectare. Dry matter intake of the animals to be 3%. (5 marks).
   b) Mr Likando wants to practise rotational grazing. The pastures will be given a rest period of 27 days and will be grazed for three days in each paddock and all the animals will be grazing together in each paddock. How many paddocks should he have? (5 marks).
   c) Using graphs explain to Mr Likando i) the quality curve of a pasture ii) the quantity curve of a pasture (5 marks).
   d) Explain also to him the factors the affect forage quality so that he knows how to give the best forage to his animals (5 marks).

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

FINAL EXAMINATIONS FIRST HALF OF 2013 ACADEMIC YEAR

COURSE:	AGG 4851: EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS
DURATION:	THREE (3) HOURS
TOTAL MARKS	100
INSTRUCTIONS:	ANSWER ALL FOUR (4) QUESTIONS. EACH QUESTION IS WORTH 25 MARKS. ANY STATISTICAL TEST SHOULD BE AT 5% SIGNIFICANCY LEVEL

QUESTION 1

Discuss the four main Principles of Research Design.

QUESTION 2

An Extension Worker considered four maize hybrid varieties for introduction to farmers in Southern Province. Before the Extension Worker could introduce them she felt that it was important to undertake a germination trial: Five varieties were tested, namely, C: Open Pollinated, the local variety grown in Southern Province; ZMS360: Hybrid from company KQ; ZMS601: Hybrid from company KQ; SEDC200: from company MP; and SEDC230: from company MP.

The following data represents the number of seeds that germinated and the number of seeds that did not germinate for each variety:

Variety:	C	ZMS360	ZMS601	SEDC200	SEDC230
Germinated:	38	34	37	45	34
Not Germinated:	16	13	15	8	15

Perform three meaningful statistical tests on the germination of these varieties and based on these tests make recommendations.

QUESTION 3

A Soil Scientist undertook a study on the influence of both soil type and spacing on yield (Kg) of groundnuts and collected the following data:

		Blocks			
Soil Type	Spacing	1	2	3	4
1	A	56	45	43	46
	B	60	50	45	48
2	A	65	61	60	63
	B	60	58	56	60

Analyse the data as you could if it was your Fifth Year Project and based on the results of the statistical analysis make recommendations.

QUESTION 4

An Animal Nutritionist was approached by Small Scale Dairy Farmers' Association (SSDF) on dairy supplementations with A: roughage; B: limited grain and C: full grain. She undertook a study and collected the following milk yield (Kg) per 205 days lactation:

	Cow		
Feeding Period	1	2	3
I	A: 608	B: 883	C: 940
II	B: 715	C: 1087	A: 766
III	C: 844	A: 711	B: 832

Analyse the data in a way that you would if it was your Fifth Year Project and make two meaningful conclusions that can be reported to the Association.

END OF EXAMINATION

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

BSc Human Nutrition

ANATOMY AND PHYSIOLOGY
AGN 2110

2013-2014

Date: Thursday 31st July 2014 Time: 09.00-12.00hrs

Duration: THREE (3) HOURS Venue: Other Rooms

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS THREE SECTIONS A, B and C

2. ANSWER ALL THE QUESTIONS IN ALL SECTIONS.

3. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS

SECTION A ANATOMY (40 Marks)

1. Which of these is NOT a constituent of saliva?

a) Salivary amylase
b) Mucus
c) Lysozyme
d) Pepsin

2. Which cell secretes pepsinogen?

a) Mucus neck cells
b) Parietal cells
c) Chief cells
d) G cells

3. Which part of the digestive tract has small adaptations called microvilli?

a) Oesophagus
b) Stomach
c) Small intestine
d) Large intestine

4. Which cell of the small intestine secretes mucous?

a) Paneth cells
b) Enteroendocrine cells
c) Absorptive cells
d) Goblet cells

5. Which constituent of pancreatic juice helps to digest fats?

a) Lipase
b) Amylase
c) Trypsinogen
d) Insulin

6. Which statement is correct with regard to the digestive system

a) Several accessory digestive organs function independently from it.
b) The wall of the alimentary canal has four main tissue layers mucosa, endometrium, myometrium, serosa.
c) The serosa is continuous with the parietal peritoneum, which lines the abdominal cavity wall.
d) The digestive system is basically about 9 to 10 cm long.

7. Which of the following is NOT an accessory structure of the digestive system?

a) The liver
b) Pancreas
c) Spleen
d) Jejunum

8. The final portion of the small intestine is the:

a) Ileum
b) Jejunum
c) Colon
d) Pylorus

9. Which of the following is not true about the pharynx?

a) Is a mucosa-lined, muscular tube
b) Has three regions nasopharynx, oropharynx, and laryngopharynx.
c) It is found superior to the throat.
d) It has portions that serve both respiratory and digestive functions.

10. The trachea...

a) extends from Pharynx to primary bronchi
b) is a smooth muscle tube lined with a ciliated mucosa that has NO mucus secreting glands
c) reinforced with C-shaped cartilage rings, which keep the trachea open.
d) lies anterior to the esophagus

11. Which of the following is not true about the lungs and pleura?

a) Are paired organs flanking the mediastinum in the thoracic cavity.
b) Are covered with visceral pleura;
c) Thoracic wall is lined with parietal pleura.
d) The lungs are primarily inelastic tissue

12. The structure which closes off the larynx is the:

a) Glottis
b) Epiglottis
c) Vocal cords
d) Uvula

13. Which of the following describes a correct order of structures in the respiratory passageways?

a) pharynx, trachea, larynx, bronchi, bronchioles
b) larynx, pharynx, trachea, bronchioles, bronchi
c) trachea, pharynx, larynx, bronchi, bronchioles
d) pharynx, larynx, trachea, bronchi, bronchioles

14. The layer of simple squamous epithelium that lines the inside of the heart is called?

a) Myocardium
b) Pericardium
c) Endocardium
d) Endometrium

15. The valve between the left ventricle and the blood vessel leaving the left ventricle is the:

a) Bicuspid valve
b) Tricuspid valve
c) Pulmonary semilunar valve
d) Aortic semilunar valve

16. The valve located between the right atrium and the right ventricle is the:

a) Tricuspid valve
b) Bicuspid valve
c) Mitral valve
d) Semilunar valve

17. Blood vessels that carry blood away from the heart are called?

a) Arteries
b) Veins
c) Capillaries
d) Lymphatics

18. The smallest types of blood vessels are?

a) Arteries
b) Arterioles
c) Venules
d) Capillaries

19. Blood pressure is highest in the:

a) Arteries
b) Arterioles
c) Veins
d) Capillaries

20. The bulk of the heart consists of?

a) Cardiac muscle
b) Smooth muscle
c) Striated muscle
d) Connective tissue

21. The location of the kidneys in relationship to the peritoneal lining of the abdominal cavity is referred to as?

a) Retroperitoneal
b) Retroabdominal
c) Dorsal
d) Ventral

22. All of the following belong to the urinary system EXCEPT the:

a) Urethra
b) Vulva
c) Bladder
d) Prostate

23. The functional unit of the kidney is called a?

a) Glomerulus
b) Nephron
c) Calyx
d) Pyramid

24. Most glucose molecules are reabsorbed in the:

a) Proximal convoluted tubules
b) Distal convoluted tubules
c) Collecting ducts
d) Loop of Henle
e) Bowman's capsule

25. The structure that connects a kidney to the ureter is the?

a) Renal calyces.
b) Urethra
c) Renal pelvis
d) Collecting duct

26. All of the following are endocrine glands EXCEPT:

a) Adrenal glands
b) Sebaceous glands
c) Pineal glands
d) Thymus

27. All of the following are hormones of the anterior pituitary EXCEPT:

a) Human growth hormone (GH)
b) Follicle-stimulating hormone (FSH)
c) Parathyroid hormone(PTH)
d) Thyroid-stimulating hormone (TSH)

28. Antidiuretic hormone and oxytocin are stored and released by the?

a) Posterior pituitary gland
b) Thyroid gland
c) Anterior pituitary gland
d) Hypothalamus

29. Calcitonin is a hormone of the?

a) Adrenal cortex
b) Thyroid gland
c) Pituitary gland
d) Parathyroid gland

30. Which one is not true about mineralcorticoids?

a) Are produced in the adrenal cortex
b) Are steroid hormones
c) Help regulate the homeostasis of sodium and potassium
d) Are minerals produced by the adrenal glands

31. The gland which can be classified as an endocrine and an exocrine gland is the?

a) Thyroid
b) Thymus
c) Pancreas
d) Pituitary

32. Glucagon ...

a) Accelerates the conversion of glycogen into glucose
b) Slows down glucose formation from lactic acid
c) Decreases the conversion of glycogen into glucose
d) Is produced by the beta islet cells of the pancreas

33. The visceral pleura...

a) is the membrane lining surface of the lungs
b) is the membrane lining the wall of the thoracic cavity
c) is the fluid around the lungs
d) is the thinnest portion of the peritoneum

34. A vertical plane through the body dividing it into right and left is termed?

a) Sagittal
b) Lateral
c) Frontal
d) Coronal

35. Histology is the study of?

a) Cells under the microscope
b) Skin
c) Organs structures
d) History of organs

36. A vertical plane through the body dividing it into right and left is termed?

a) Sagittal
b) Lateral
c) Frontal
d) Coronal

37. What is the function of serous membranes?

a) To prevent fluid loss from an organ
b) To reduce friction between internal organs
c) To circulate blood around the organ
d) To produce heat within the organ

38. Progesterone can be produced from all the following except?
a) Corpus luteum
b) Theca cells
c) Mature granulose cells
d) Uterine endometrium

39. Which of the following is a hormone of the female reproductive cycle?

a) Prolactin
b) FSH
c) Oxytocin
d) ADH

40. Which statement is true about semen?

a) Semen is slightly acidic
b) Semen can be 1.5 to 6 litres per ejaculation
c) The volume of semen is 1ml and normally contains 10 to 20 million sperms
d) Bulbourethral gland contributes a small volume of semen.

SECTION B (40 Marks)

1. Name the hormones produced from the anterior pituitary and how these hormones function **(5 marks)**

2. a. Write brief notes on the anatomy of the gall bladder **(4 marks)**

b. What organ produces cholecystokinin? **(1 mark)**

3. Write brief notes on the function and different types of immunogloblins stating where they are found in the body **(5 marks)**

4. a. Write short notes on interferons. **(3 marks)**

b. List the signs of inflammation. **(2 marks)**

5. State the causes of metabolic acidosis and metabolic alkalosis. **(5 marks)**

6. Write short notes on the Menstrual (Uterine) Cycle. **(5 marks)**

7. State the functions of testosterone in males. **(5 marks)**

8. Write short notes on the formation/occurrence of goiter. **(5 marks)**

SECTION C (20 Marks)

1. What blood vessel has valves? **(1 mark)**
2. *True/False:* During fetal circulation, fetal and maternal blood mix? **(1 mark)**
3. Mention one function of the umbilical cord during fetal circulation. **(1 mark)**
4. Respectively, the right and left atrioventricular (AV) valves are also referred to as? **(1 mark)**
5. From the L ventricle, blood flows into the.....? **(1 mark)**
6. The pulmonary veins carry blood to the....? **(1 mark)**
7. *True/False:* The epicardium and the fibrous pericardium are the same structure? **(1 mark)**
8. What is also known as the pacemaker of the heart? **(1 mark)**
9. *True/False:* The uvula is found at the base of the tongue? **(1 mark)**

10. *True/False:* Calcium is the major component of muscle? **(1 mark)**

11. Define interpleural pressure **(1 mark)**

12. State the two main functions of the respiratory system **(1 mark)**

13. List the composition of the urinary system **(1 mark)**

14. State the hormones responsible for glucose regulation **(1 mark)**

15. State the name, mode of action and use of any known diuretic **(1 mark)**

16. State the hormones involved in calcium regulation **(1 mark)**

17. Which hormones are responsible for the "fight-or-flight" response? **(1 mark)**

18. The exchange of gases between blood and tissue cells is called? **(1 mark)**

19. The process of taking food into the digestive system is known as? **(1 mark)**

20. Bile is produced in the...? **(1 mark)**

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

BSc HUMAN NUTRITION

AGN 2212: PRINCIPLES OF HUMAN NUTRITION

2013/2014 ACADEMIC YEAR

Date: 25/07/2014 **Time: 09.00 – 12.00 Hours**

DURATION: THREE (3) HOURS **VENUE: OMNIA 3**

INSTRUCTIONS TO THE CANDIDATES:

1. **THIS PAPER CARRIES 100 MARKS AND HAS TWO SECTIONS [SECTIN A AND B]**
2. **ANSWER ALL THE QUESTIONS IN ALL SECTIONS.**
3. **ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS**

SECTION A: ANSWER ALL QUESTIONS (TOTAL MARKS - 10)

1. One (1) example of a pancreatic protease is _____ (1 mark)
2. Name a food acid found in tea and cocoa: _____ (1 mark)
3. Lingual lipase hydrolyses triacylglycerols (TAGs) in the _____ (1 mark)
4. _____ is a more digestible starch polymer than _____ (1 mark)
5. Name two (2) water soluble vitamins important in the human diet. (1 mark)
6. State two factors that can affect protein synthesis (1marks)
7. Name the two methods recommended by the Food and Agriculture Organization (FAO) for the assessment of protein quality. (1 marks)
8. List two functions of zinc in the human body. (1 marks)
9. State two risks of amino acid supplementation. (1 marks)
10. List two symptoms of Vitamin A deficiency. (1 marks)

SECTION B: ANSWER ALL QUESTIONS. (TOTAL MARKS - 90)

Question 1 (15 marks)

Answer the following questions on carbohydrates

a. Some carbohydrates yield 4 kcal / g of energy while others provide about 2 kcal / g of energy. Why is there such a disparity? **(5 marks)**

b. Discuss the digestion of carbohydrates in the human body starting in the mouth until materials are defecated **(10 marks)**

Question 2 (20 marks)

Carbohydrates are important food components in the body and they support the day to day metabolic functions of the human body. However, imbalances in this carbohydrates or deficiencies in enzymatic functions cause drastic changes in the body that lead to various metabolic diseases. Answer the following:

a. Outline the physiological differences between type I and type II diabetes. Illustrate these differences using a diagram(s) **(10 marks)**

b. Lactose intolerance is a common condition in some regions of the world causing discomfort in individuals that have this condition.

i. What enzyme is affected in individuals who are lactose intolerant? **(1 mark)**

ii. List three (3) symptoms associated with this condition (lactose intolerance) **(3 marks)**

iii. List two (2) remedies that can help a lactose intolerance individual **(2 marks)**

iv. Lactose intolerance individuals can consume milk products such as yoghurt, buttermilk and related milk products from cows but digest fresh cow's milk. Briefly explain why their systems can tolerate certain products but not others and yet they all come from the ame type of animal. **(4 marks)**

Question 3 (20 marks)

a. Explain the five key principles of diet planning. (10 marks)

b. Amina's 6 year old child develops the following symptoms: weight loss, weakness, wasted muscles, loss of sensation, pins and needles, difficulty walking, wrist drop, hair loss, diarrhea, skin lesions, poor appetite and diminished taste acuity. He is brought to hospital. Being the nutritionist in the health centre, working alongside the

doctor, you are asked to do proper diagnosis using clinical assessment and provide advice to the mother's child.

i. Given the above symptoms, what two possible deficiencies does the child have? (2 marks)
ii. How can the condition be treated? (4 marks)
iii. Name 4 locally available foods that the mother should give to the child to prevent the condition from recurring. (4 marks)

Question 4 (20 marks)

a. Briefly explain the role of tRNA, mRNA, and ribosomes in protein synthesis (6 marks)

b. State four functions of proteins in the human body (4 marks)
c. Paul is in an athlete and is involved in strenuous physical exercises. He weighs 75 kg. Calculate his daily protein requirement. (2 marks)
d. Explain what is meant by zero, positive, and negative nitrogen balance and name health conditions associated with each (8 marks)

Question 5 (15 marks)

a. List two causes of Wernicke-Korsakoff syndrome (2 marks)
b. State four clinical signs of Wernicke-Korsakoff syndrome (2 marks)
c. Name four population groups or types of environment where significantly high prevalences of rickets and osteomalacia are still found today. (2 marks)
d. State and briefly explain any three factors that affect the absorption of fat (7 marks)
e. Explain two ways to enhance the absorption of zinc and iron from maize meal porridge (2 marks)

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

BSc Human Nutrition

AGN 3222: HUMAN NUTRITION

2013/2014 ACADEMIC YEAR

Date: 14/07/2014 **Time: 14 – 17 Hours**

DURATION: THREE (3) HOURS **VENUE: OTHER ROOMS**

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS TWO SECTIONS [SECTIN A AND B]
2. ANSWER ALL THE QUESTIONS IN ALL SECTIONS.
3. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS

SECTION A: ANSWER ALL QUESTIONS (TOTAL MARKS - 20)

1. Name four groups of individual that are at most risk of selenium deficiency. (2 marks)
2. Name one rich dietary source for each of the following vitamins. (2 marks)
    a) Riboflavin
    b) Vitamin E
3. What are goitrogens? (1 mark)
4. List four specific symptoms of zinc deficiency. (2 marks)
5. State four dietary sources of Vitamin D (2 marks)
6. State two clinical signs of osteomalacia (1 mark)
7. Name one compound that enhances iron bioavailability and one compound that inhibits iron bioavailability (2 marks)
8. State one difference between retinoids and carotenoids and name two examples of foods rich in each (4 marks)
9. State the old and new conversion factors of b-carotene to retinol (2 marks)
10. State two (2) consequences of folate deficiency. (2 Marks)

SECTION B: ANSWER ALL QUESTIONS. (TOTAL MARKS - 80)

Question 1

a. Explain two methods used to estimate protein requirements for the human body. (6 marks)
b. Explain four effects of overconsumption of proteins (8 marks)
c. Calculate the safe level intake of protein for a 25 year old lady, who weighs 65Kg and lives a sedentary lifestyle (2 marks)
d. A day's diet of a 28 year pregnant woman contains 65 grams of protein, 50 grams of fat, and 350 grams of carbohydrates.
    i. How many Kilo calories does this diet contain? (2 marks)
    ii. Indicate whether this diet it is adequate or inadequate in meeting the energy requirements during pregnancy? Give reasons for your answer (2 marks)

Question 2

a. Outline the three steps that should be followed in the treatment of infantile beriberi to a 9 months old child (6 marks)
b. Why is beriberi not found in populations that consume parboiled rice, but can be prevalent in populations that consume highly milled, polished rice? (2 marks)
c. List four (4) clinical signs of pellagra. (2 marks)
d. State four causes of pellagra. (4 marks)
e. State four factors that enhance the absorption of calcium in the human body (4 marks)

Question 3

a. Explain the difference between iron deficiency and anaemia. (4 marks)
b. Which two tests are recommended for measuring iron deficiency? Explain why one test would not be sufficient to get a clear picture? (4 marks)
c. Explain three (3) strategies to reduce the prevalence of anaemia in ~~the~~ Zambia. (9 marks)
d. For each of the strategies in (iii) above, state one advantage and two disadvantages of each of the strategies in the Zambian context. (3 marks)

Question 4

The following question relates to food composition tables

a. List three possible sources of error in a food composition table (3 marks)
b. Describe three different type of possible data sources in a food composition table (9 marks)
c. Which two key factors do you have to take into account when calculating the nutritional value of a recipe? (4 marks)
d. State ~~three~~ FOUR consequences of vitamin A deficiency. (4 marks)

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

BSc Human Nutrition

Principles of Dietetics
AGN 3232
2013-2014

Date: Thur 24th July 2014 **Time: 14.00-17.00hrs**

Duration: THREE (3) HOURS **Venue: Other Rooms**

INSTRUCTIONS TO THE CANDIDATES:

1. **THIS PAPER CARRIES 100 MARKS AND HAS TWO SECTIONS, A & B**

2. **ANSWER ALL THE QUESTIONS IN ALL SECTIONS.**

3. **ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS**

Section A: (Total 25 marks)

1. a. Briefly explain the significant history you would need in the development of a patient/client dietary plan. **(2 marks)**

   b. In addition to the significant history, state other subjective data you would include in order to develop a patient/clients dietary plan. **(2 marks)**

2. Name the main lipoproteins and explain how they are classified. **(2 marks)**

3. What is dyslipidaemia? Briefly explain the diet you would recommend in dyslipidaemia. **(2 marks)**

4. What are the objectives of a fat restricted diet in gall bladder diseases cholecystitis and cholelithiasis? **(2 marks)**

5. Why is a clear-liquid diet indicated in acute liver disease? **(2 marks)**

6. a. What is the rationale behind controlling/restricting protein in acute renal failure? **(3 marks)**

   b. Name the metabolite(s) that are used to assess kidney function. **(1 mark)**

7. Briefly explain why sodium is restricted in hypertension. **(2 marks)**

8. What are the contraindications of clear liquid diets? **(2 marks)**

9. a. What is anorexia nervosa? **(1 mark)**

   b. List the risk factors of anorexia nervosa. **(2 marks)**

10. Define Kosher and Halal foods. **(2 marks)**

Section B: (Total 75 Marks)

1. Describe the role of a high fibre diet in the management of the following conditions:
   a. Constipation and diverticulosis **(10 marks)**
   b. Diabetes mellitus Type II **(10 marks)**

2. Mollie is a 25 year old woman who attends school at a Lusaka Business College. Two years ago Mollie failed two major accounts subjects and, as a result, she was asked to repeat the whole academic year. Mollie has since been gaining weight steadily and now weighs 90kg with a waist circumference of 97cm. Mollie is 1.5 metres tall.
   a. Explain in detail how you would dietetically manage Mollie's weight and include appropriate biochemical tests you would need. **(10 marks)**
   b. Name any other two members of the health care team that you would refer Mollie to and give reasons to support your answers? **(6 marks)**
   c. What are the disadvantages of using drugs and surgery in weight management? **(4 marks)**

3. a. Outline the role of dietetics in National Development **(10 marks)**
   b. Suggest methods/ways of preventing non-communicable diseases (NCD's) in Zambia **(5 marks)**

4. a. What are the objectives of nutrition in sports? **(12 marks)**

   b. Using an appropriate formula calculate the Basal Energy Expenditure (BEE) and the total energy requirement for a 40 year old man who has undergone major surgery (*classified as severe metabolic stress*) who weighs 60kg and is 1.68 meters tall. The patient is an in-patient and is confined to bed (*nutrition care after peristalsis resumes*). **(8 marks)**

THE UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Food Science and Technology

BSc Human Nutrition

NUTRITION ASSESSMENT
AGN 3311

2013-2014

Date: March 7, 2014; Venue: VLT
Time: 09:00hrs – 12:00hrs; Duration: 3 Hours

ANSWER ALL QUESTIONS IN BOTH SECTIONS A AND B

READ ALL QUESTIONS CAREFULLY

SECTION A (20 marks total)

1 State two underlying causes of malnutrition. (2 marks)

2 State any two uses of nutritional assessments. (2 marks)

3 List two field based methods of biochemical analysis that can be used to diagnose iron deficiency anemia in individuals. (2 marks)

4 List two clinical signs of each of the following deficiencies (2 marks):
a) Vitamin A deficiency
b) Iron deficiency anaemia

5 State four advantages of a food frequency questionnaire. (2 marks)

6 State and briefly explain how seasonality and the environment can affect the child's growth. (4 marks)

7 List any two hormones that are important for growth. (2 marks)

8 What does waist-to-hip ratio measure? (1 mark)

9 What does BMI for age measure? (1 mark)

10 State four negative outcomes associated with chronic malnutrition. (2 marks)

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SECTION B (Total 80 marks; 20 marks per question)

1. You are involved in a national nutrition survey and, as a nutritionist in-charge of your station, you are expected to collect data on child measurements and other relevant data.
   a) Explain in detail how you would accurately obtain the weight and length of a child aged 10 months. (12 marks)
   b) What are the common sources of error in anthropometry, and how can they be overcome? (8 marks)

2. a) What are the arguments for and against using international reference standards and national standards for child growth? (14 marks)
   b) Why is weight for age not useful in defining undernutrition in children under five? (2 marks)
   c) State two biochemical methods that can be used to assess the Vitamin A status of individuals in a population. (2 marks)
   d) What are the cut-offs that you would apply to define the iron status of women of child bearing age? (2 marks)

3. Discuss the 24 hr recall and food frequency questionnaire as methods of dietary assessment. For each method outline three challenges in collection, analysis and interpretation of dietary assessment data. (20 marks)

4. a) What are the advantages and disadvantages of using anthropometry to measure the nutritional status of individuals? (10 marks)

b) Briefly describe the difficulties in assessing the nutritional status of the elderly. (4 marks)

c) The WHO international reference standards for growth give the following reference data for a 42 month old boy:

Indicator:	- 3SD	- 2SD	- 1SD	Median	+ 1SD	+2 SD	+3 SD
BMI for age:	12.2	13.2	14.3	15.4	16.8	18.2	19.8
Height for age:	88.0	91.9	95.9	99.9	103.8	107.8	111.7

i) If a boy aged 42 months weighs 15 kg and has a height of 90 cms, is he:

- Chronically malnourished only?
- Acutely malnourished only?
- Both chronically and acutely malnourished?
- None of the above?

Tick the correct answer above (4 marks).

ii) What advice would you give to the mother in order to improve the nutritional status of the child? (2 marks)

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

BSc Human Nutrition

Nutrition Communication and Health Promotion
AGN 3510
2013-2014

Date: Thur 31st July 2014 **Time: 09.00-12.00hrs**

Duration: THREE (3) HOURS **Venue: Other Rooms**

INSTRUCTIONS TO THE CANDIDATES:

1. **THIS PAPER CARRIES 100 MARKS AND HAS TWO SECTIONS, A & B**

2. **ANSWER ALL THE QUESTIONS IN ALL SECTIONS.**

3. **ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS**

Section A: (TOTAL 20 MARKS)

1. List TWO strategies that can be used as part of 'The Advocacy Toolbox'? **(2 MARKS)**

2. According to the Ottawa Charter there are nine fundamental conditions and resources required for health, name TWO of these? **(2 MARKS)**

3. What is meant by 'Social Communication' in nutrition education? **(2 MARKS)**

4. What is grey literature; please give an example to support you answer? **(2 MARKS)**

5. In health behaviour change there are two types of theoretical model, what are these. Give an example for each? **(2 MARKS)**

6. Why would you conduct a health needs assessment? **(2 MARKS)**

7. List any ONE of the five 'READS' principles of motivational interviewing? **(2 MARKS)**

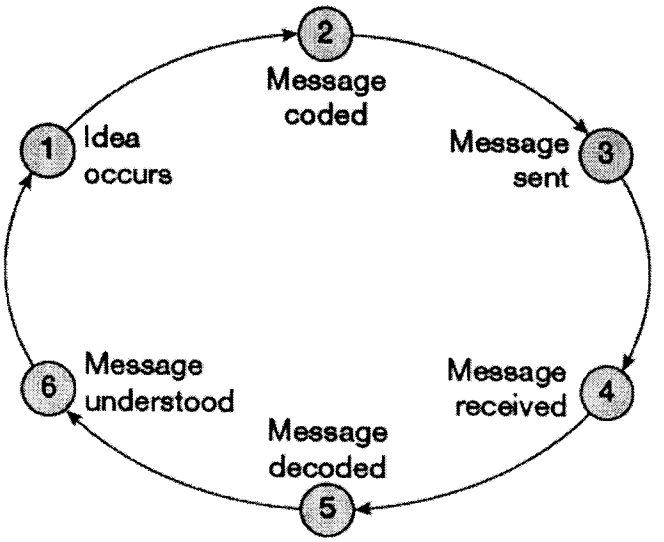
8. What must you do BEFORE producing support materials for a nutrition education programme, and which key group should this process involve? **(2 MARKS)**

9. According to the World Health Organisation (WHO) what is Health? **(2 MARKS)**

10. In terms of ethics in scientific writing what is ORIGINALITY? **(2 MARKS)**

Section B: (TOTAL 80 MARKS)

1. You are a nutritionist working in a heart health clinic giving individual, one-one dietary advice to heart attack survivors on reducing their fat and salt intake. Using the communication cycle below, discuss the key considerations needed at each stage to ensure effective communication between you and the patient. **(20 MARKS)**



2. **a.** List FIVE different factors that affect food choice, giving an example for each **(10 MARKS)**

   b. Discuss why identifying factors that affect food choice within a community is important when developing health promotion Information, Education and Communication (IEC) materials. **(10 MARKS)**

3. Nutrition education planning is based on a theoretical framework, and consists of four phases. Name these phases and describe the key activities that take place during each. **(20 MARKS)**

4. **a.** Outline any THREE steps needed in developing an advocacy strategy. **(6 MARKS)**

   b. Choose ONE nutrition message that fits into the *'1st 1000 days'* campaign for Zambia and use this message to give a detailed example of what you would do at each step outlined in question 4a. **(14 MARKS)**

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

BSc Human Nutrition

Nutrient and Drug Interactions
AGN 4122
2013-2014

Date: Wed 16th July 2014 **Time: 14.00-17.00hrs**

Duration: THREE (3) HOURS **Venue: Other Rooms**

INSTRUCTIONS TO THE CANDIDATES:

1. **THIS PAPER CARRIES 100 MARKS AND HAS FOUR SECTIONS A, B, C & D**

2. **READ INDIVIDUAL SECTION INSTRUCTIONS CAREFULLY.**

3. **ANSWER ALL THE QUESTIONS IN ALL SECTIONS.**

4. **ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS**

SECTION A : MULTIPLE CHOICE (30)

Choose ONLY 1 answer in the following 20 questions

1. **Which of the following is NOT an example of a nutritional supplement?**

   ☐ a Omega-3 rich fish oil
   ☐ b Calcium tablets
   ☐ c Ginger-enriched shampoo
   ☐ d Garlic tablets (1.5)

2. **Which answer is NOT an example of an ergogenic aid?**

   ☐ a Caffeine improves concentration in a tennis player
   ☐ b A new swim-suit helps an swimmer to swim faster
   ☐ c Omega-3 capsules improves blood cholesterol levels
   ☐ d Protien supplements help a athelete to build more muscle (1.5)

3. **Which of the following statements about the quality of nutritional supplements is true?**

   ☐ a Supplement quality is legislated by the FDA
   ☐ b Supplements always contain exactly what the label indicates
   ☐ c Supplements can have inadequate amounts of active components
   ☐ d Supplements are classified as drugs and must therefore get tested (1.5)

4. **Which statement about diuretics is true?**

   ☐ a Spironolactone can cause hypokalaemia
   ☐ b Thiazide diuretics can cause hypocalcaemia
   ☐ c Loop-diuretics can cause hypocalcaemia and hyperkalaemia
   ☐ d All three these diurectic groups can cause hyponatraemia (1.5)

5. **Which statement about Colestyramine is true?**

   ☐ a Colestyramine binds bile acids and inhibits their reabsorption
   ☐ b Colestyramine can be used to treat hypercalcaemia
   ☐ c Long term use requires supplementation with pyridoxine
   ☐ d Colestyramine forms a bond with dietary cholesterol (1.5)

6. **Which of the following statements about insulin is INCORRECT?**

- [ ] a Insulin can be synthetically made or extracted from pork pancreas
- [ ] b Insulin is usually administered subcutaenously
- [ ] c Insulin can be used in the treatment of gestational diabetes
- [ ] d Insulin should never be given with other anti-diabetic drugs (1.5)

7. **Which statement about biphasic insulin is correct?**

- [ ] a The onset of novomix30 is the same as novorapid
- [ ] b The duration of action is the same for novomix30 and novorapid
- [ ] c Novomix30 contains 70% rapid-acting insulin
- [ ] d Novomix30 can be used as part of a basal-bolus regime (1.5)

8. **Choose the correct answer about basal-bolus insulin regimes.**

- [ ] a This is the best regime if patients are able to adjust their own insulin units
- [ ] b This is the best regime if the timing and type of meals in a diet changes daily
- [ ] c A patient will need to have two different insulin pens
- [ ] d All of the above (1.5)

9. **When a patient develops oral thrush...**

- [ ] a this may cause nausea and therefore reduced intake
- [ ] b this will give patients a sour taste in their mouth
- [ ] c the patient should be treated with Nyastatin mouth drops
- [ ] d oral thrush can be casued by anaemia (1.5)

10. **Which statement about ethanol is INCORRECT?**

- [ ] a Ethanol can increase the gastric-irritant effect of NSAIDs
- [ ] b Ethanol can contribute to hypoglycaemia in diebetics
- [ ] c Ethanol can enhance hepatotoxicity of drugs
- [ ] d Ethanol is a macronutrient which contributes 4kcal/g (1.5)

11. In a patient with bipolar disorder, blood lithium concentration..

- ☐ a will increase if the patient dehydrated
- ☐ b will increase if the patient is fluid overloaded
- ☐ c is dependant on potassium excretion in the kidneys
- ☐ d is an example of drugs effecting nutrient excretion (1.5)

12. Hypokalaemia can be the result of..

- ☐ a combined use of ramipril and spironolactone
- ☐ b refeeding syndrome in an anorexic patient
- ☐ c constipation due to opiods
- ☐ d none of the above (1.5)

13. Iatrogenic means?

- ☐ a the cause of a medical symptom is unknown
- ☐ b a change in a patient's condition is due to medical intervention
- ☐ c a medical intervention was unsuccessful
- ☐ d the cause of a disease is unknown (1.5)

14. Which of the following is NOT a possible cause of hypoalbuminaemia?

- ☐ a Albumin binding to therapeutic agents
- ☐ b Reduced albumin synthesis
- ☐ c Increased albumin excretion
- ☐ d Albumin forms part of the acute phase response (1.5)

15. A likely cause for low blood calcium levels is..

- ☐ a hyperparathyroidism
- ☐ b chronic prednisolone treatment
- ☐ c malignancy
- ☐ d a sedentary lifestyle (1.5)

16. **All the following factors make nutriet-drug interaction more likely, EXCEPT for..**

- ☐ a polypharmacy
- ☐ b pharmacophobia
- ☐ c enteral feeding
- ☐ d renal failure

(1.5)

17. **Bioavailability is..**

- ☐ a the fraction of drug that becomes available for use
- ☐ b always 50% for IV drugs
- ☐ c the biotransformation of a drug in the liver
- ☐ d the fraction of drug eliminated after 24 hours

(1.5)

18. **Enteral feeding reduces phenytoin blood concentration with 75%.**

- ☐ a This is a pharmacokinetic effect
- ☐ b Phenytoin acts as the precipitant agent
- ☐ c This is an example of nutrition affecting drug metabolism
- ☐ d Enteral feeding acts as the object agent

(1.5)

19. **An enteric coating on a tablet can be used to..**

- ☐ a prevent a drug from being broken down by stomach acid
- ☐ b prevent the stomach mucosa from the drug's irritant effect
- ☐ c slow down the absorption of a drug
- ☐ d all of the above

(1.5)

20. **Which drug would you not give through a naso-jejunal tube?**

- ☐ a an antacid
- ☐ b paracetamol
- ☐ c amlodipine
- ☐ d an anti-convulsant

(1.5)

Section A total (30)

SECTION B : SHORT QUESTIONS (18)

Question 1:

Match the nutrient drug interaction with the appropriate category.

a Warfarin is high in a malnurished patient
b Furosemide cuases hypokalaemia
c Sorbitol in sugar-free cough mixture cause diarrhoea
d Liquorice causes a hypertensive crisis in a patient on diuretics
e Phynetoin levels are low due to enteral feeding
f Antibiotics cause diarrhoea and thereby hypokalaemia
g A patient's sedative works poorly due to high caffeine intake
h Dairy food reduces ciprofloxacin's effectiveness (example)
i Isoniazid inhibits the activation of pyridoxine
j Grapefruit increases blood nifedipine concentration
k Over-prescription of laxatives cause diarrhoea and weight loss

add the letter of the interaction into the corresponding box

h	Effect of nutrients on drug absorption (example)	
	Drugs affect nutrient metabolism	(1)
	Modification of drug action by nutrients	(1)
	Effect of nutrients on drug distribution	(1)
	Drug excipients affect nutritional status	(1)
	Drugs affect nutrient absorption	(1)
	Effects of drugs on nutritional status	(1)
	Effect of nutrients on drug excretion	(1)
	Drugs affect nutrient excretion	(1)

Question 2:

Match these drugs to the correct nutritional interaction

a Actrapid
b The ACE-inhibitor, Ramipril
c Morphine
d Warfarin
e Monoamine-oxidase inhibitors
f Calcium Channel blocker
g Sucralfate
h Metformin
i Sequinavir
j Aspirin
k Rifampicin

add the letter of the drug into the corresponding box

☐	nausea and weight loss in early stages	(1)
☐	hyperglycaemia and metabolic changes	(1)
☐	hypertensive crisis when eating vintage cheddar and unfiltered beer	(1)
☐	reduced gastric motility and constipation	(1)
☐	forms clumps when given with enteral feed	(1)
☐	hypoglycaemia when taken without a meal	(1)
☐	hypotension in a patient eating grapefruit	(1)
☐	nausea and vomiting	(1)
☐	a sudden increase in green leavy vegetables causes an internal bleed	(1)
☐	hyperkalaemia	(1)

Section B total (18)

SECTION C : CASE STUDIES (37)

Question 1

A 76-year old lady is admitted to the high dependency unit. She was in a road traffic accident. She is currently unconscious and on IV fluids. You are asked to start her on enteral feeding.

Primary Medical History	**Current medication list**
Type 2 Diabetes Mellitus	Novomix30 25 at 7am
Hypertension	Novomix30 25 at 7pm
Hyperlipidaemia	Ramipril 10mg OD
GORD	Simavastatin 20mg OD
BMI 32 kg/m2	Sucralfate 1g QDS
	Omeprazole 40mg OD
	Morphine 10mg QDS

a) Which one of her current medications is contra-indicated with enteral feeding? Provide a brief explanation (2)

b) The patient is given insulin without food and has an unresponsive hypoglycaemic episode. What is the appropriate treatment for this? (1)

c) Elderly patients are more likely to experience nutrient-drug interactions. Provide 4 reasons for this. (4)

d) The patient has not opened her bowels in the last week. Which drug could be contributing to this? Provide two treatment options to improve her constipation. (3)

e) What *type* of enteral feeding regime would work best, given the patient's condition and insulin regime? (1)

f) After a few days the patient's NG-tube becomes blocked. The nurses have tried to unblock it with warm water without success. Can you suggest two other options? (2)

Question 2

A 46-year old man is admitted to the medical ward for treatment of a chest infection with antibiotics. After a week in hospital he develops a DVT and is started on warfarin. As the patient's chest infection starts to clear up a few days later, he develops severe diarrhoea.
A stool culture comes back positive of *clostridium difficile.*

Primary medical history	**Current medication list**
COPD	Prednisolone 10mg OD
Hypertension	Co-amoxiclav (Augmentin) 1g BD
Oesophageal reflux	Theophylline 250mg BD
Smoker	Amlodipine 10mg OD
BMI 29 kg/m2	Omeprazole 20mg OD
	Salbutamol inhaler 100mg PRN
	Aspirin 300mg OD

Recent blood biochemistry		**Value**	**Range**	**Unit**
Na		136	135 - 150	mmol/L
K		4.2	3.5 - 5.0	mmol/L
Alb		22	35 - 45	g/l
Ca		1.84	1.90 - 2.40	mmol/L
coCa		2.21	2.25 - 2.65	mmol/L
P04		1.31	0.8 - 1.5	mmol/L
Hb	*male*	7.8	13.0 - 18.0	g/dl
MCV		105	77 - 95	fl
RDW		12.7	11.5 - 14.5	%
Ferritin	*male*	156	18 - 270	ng/ml
WBC		18.4	4.0 - 11.0	x 109/L
CRP		134	0 - 11	mg/L
Vitamin B12		34	150 - 700	ng/L
Folate		7.2	2.0 - 11.0	µg/L
INR		3.7	0.8 - 1.2	

a) What does the patient's low albumin indicate? (1)

b) Given the time of diarrhoea onset, which medication is responsible and how does this happen? (2)

c) Which medication could be contributing to the low calcium? (1)

d) Give 2 mechanisms for your answer in d) (1)

e) Which two medications should be taken on an empty stomach and why? (3)

f) The patient has anaemia. What type of anaemia does the patient have? Give a reason for your decision. (2)

g) Which medication may have contributed to the patient's anaemia? (1)

h) During the admission, the patient's INR rises to above the therapeutic range. Describe a nutritional cause for this including the type of nutrient-drug interaction. (2)

Question 3

You see a 27-year old female in clinic to help her lose weight and eat healthier. See has been on HAART for the last 12 months. More recently she started a SSRI anti-depressant. This is not been working very well and her doctor is considering a change to a Monoamine-oxidase inhibitors (MAOIs). She also tells you that she uses a garlic supplement to improve her immune function.

Primary medical history
HIV
Hypertension
Hyperlipidaemia
Insulin resistence
BMI 31 kg/m2

Current medication list
Citalopram 40mg OD
Lamivudine 150mg BD
Sequinavir 300mg BD
Efavirenz 600mg OD
Nifedipine 10mg OD
Simvastatin 20mg OD
Paracetamol 500mg PRN
Vitamin C 250mg OD

Diet History

Breakfast	1 slice bread aged cheddar cheese 1 glass grapefruit juice
Lunch	1 x marmite and cheese sandwich 1 x apple a handful of peanuts
Dinner	1 x chicken breast green beans green salad with a soy dressing a home-brewed beer

a) Your client has had a recent increase in weight despite trying to eat better. Which drug could have contributed to this? (1)

_____

b) Name two nutrients in her diet that can affect her sequinavir levels and the mechanism behind each (4)

_____

_____

_____

_____

c) Which other medications in her diet can be affected by the same foods? (2)

_____

_____

d) If she changes to a MAOIs antidepressant, which **foods** in **HER** diet would she need to limit? (3)

_____

_____

e) She suffers from a metabolic condition as a result of her medical treatment. What is it called? (1)

_____

Section C total (37)

SECTION D : ARTICLE ASSESSMENT (15)

Read the article on cinnamon supplementation and the answer the following question:

Question 1:

Would you recommmend cinnamon supplementation based on this article? Also consider the additional information provided below to help your decision. Describe the reasons for making this decision.

(15)

Additional information:

Diabetes related biochemistry

blood value	*Normal reference range*	*Good diabetic control*	*Unit*
fasting BGL	3. 9 - 5.5		mmol/l
HbA1c	< 42	42 -48 mmol/l	mmol/mol

Additional information about some of the article's references

a) Reference 10 is a meta-analysis that shows an average fasting BGL improvement of 0.5mmol/L with the use of various cinnamon supplements. The dosesage used is not quantified.

b) Reference 11 is a meta-analysis that shows an average HbA1c improvement of 1 mmol/mol after 2 -4 months of supplementation with 1 - 6g cinnamon form food or supplements.

c) Reference 12 is a meta-analysis of 'true' cinnamon efficacy. In vitro and in vivo results shows an improvement in insulin sensitivity. No human studies are included.

d) Reference 5 reviewed the safety and upper limit of coumarin. The study concluded that frequent use of cassica cinnamon through food or supplementation can exceed the TDI (tolerable daily intake).

Section D. Question 1 answer sheet

Section D. Question 1 answer sheet

Section D total (15)

Exam total (90)

THE UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Food Science and Technology

BSc Human Nutrition

NUTRITION DISORDERS
AGN 4241

2013-2014

Date: March 4, 2014; Venue: OMNIA 1
Time: 09:00hrs – 12:00hrs; Duration: 3 Hours

ANSWER ALL QUESTIONS IN BOTH SECTIONS A AND B

READ ALL QUESTIONS CAREFULLY

SECTION A (20 marks total; 2 marks per question)

1. In high and middle income countries, what are three important contributors to the index Disability Adjusted Life Years (DALYs)?
2. Define food and nutrition security.
3. The prevalence of low birth weight in Zambia is stated to be 9%. Why is this likely to be an underestimate?
4. Define reductive adaptation.
5. What biochemical marker would you use to assess the risk of zinc deficiency in a population?
6. List four signs of severe malnutrition.
7. List two challenges to achieving successful outcomes through programmes to improve diet diversity.
8. What is the most common measure of obesity, and what is the main limitation of this measure?
9. What is metabolic syndrome and how is it defined?
10. According to the *World Cancer Research* report there is convincing evidence that body fatness increases the risk of certain cancers. Name TWO of these cancers.

****

SECTION B (Total 80 marks; 20 marks per question)

1. In the 1970s, the local government of the state of Kerala in India decided to focus a large part of its budget on improving the education of women. Five years later, the prevalence of underweight had fallen by 50%. Discuss.
2. Identify and discuss three positive features and three possible risks associated with Zambia's Harvest Plus project.
3. a) List and comment briefly on the ten steps recommended by the WHO for the successful management of a severely malnourished child.
   b) List four things you must <u>not</u> do during the treatment of a severely malnourished child.
4. a) What are the FIVE steps that can be taken to prevent hypertension and what are the consequences of high blood pressure on health?
   b) Evidence has shown that dietary interventions can effectively reduce blood pressure in pre-hypertensive and hypertensive individuals. What advice, in terms of modifying diet and lifestyle, would you give to a patient who is trying to reduce his/her blood pressure?

****

THE UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Food Science and Technology

BSc Human Nutrition

RESEARCH METHODS AND EPIDEMIOLOGY FOR NUTRITIONISTS
AGN 4321

2013-2014

Date: March 6, 2014; Venue: VLT
Time: 14:00hrs – 17:00hrs; Duration: 3 Hours

ANSWER ALL QUESTIONS IN BOTH SECTIONS A AND B

READ ALL QUESTIONS CAREFULLY

SECTION A (20 marks total)

1 Define the following terms as used in research (2 marks):
   a) Hypothesis
   b) Sample

2. List four data collection methods that can be utilized in qualitative research. (2 marks)

3. Explain the following sampling procedures (4 marks):
   a) Stratified random sampling
   b) Snowball sampling

4. What factors should a researcher consider when calculating the sample size? (2 marks)

5. State two limitations of systematic reviews specific to health promotion (2 marks)

6. State four differences between true experiments and quasi experiments (2 marks)

7. Explain how the following factors are threats to internal validity in experimental research design (2 marks):
   a) Pre-testing
   b) Maturation

8. Using the APA style, write out how these reference materials should appear in the reference section of a report. (4 marks)

   a) Book:
   Title of book: Principles of Nutritional Assessment
   Publisher: Oxford university press
   Year of Publication: 1990
   Author: Gibson, Rosalind
   Place: New York, USA

   b) Article:
   Title of article: Prevalence and correlates of obesity among Lusaka residents, Zambia: a population-based survey
   Authors: Emmanuel Rudatsikira, Adamson S Muula, David Mulenga, and Seter Siziya
   Name of journal: International Archives of Medicine
   Year: 2012,
   Issue: 5
   Volume:1
   Pages: 236 – 242

****

SECTION B (Total 80 marks; 20 marks per question)

1. a) Distinguish between cohort studies and case control studies. Provide an example in each case. (10 marks)
   b) What are the strengths and limitations to carrying out a cohort study? (10 marks)

2 a) Discuss uses of nutritional epidemiology. (10 Marks)
   b) What are the challenges of studying contemporary nutrition-related diseases? (10 marks)

3. a) List and briefly explain the key six steps in the research process. (12 marks)
   b) Explain four ethical issues that should be observed when carrying out research. (4marks)
   c) Explain the importance of literature review in research. (4marks)

4. a) Describe the key features of quantitative and qualitative research. (8 marks)
   b) State two types of qualitative research, and describe the defining feature of each of them? (4 marks)
   c) Distinguish between experimental and descriptive designs. (8 marks)

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

BSc HUMAN NUTRITION

AGN 4410: DIET FORMULATION AND DIETETIC MANAGEMENT

2013-2014

DATE: 29th JULY 2014 **TIME: 14:00 HOURS**

DURATION: THREE (3) HOURS **VENUE: OMNIA 2**

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS TWO SECTIONS: A AND B
2. APPENDIX A (LAST PAGE) REFERS TO THE COMPULSORY QUESTION (B1) IN SECTION B
3. ANSWER ALL THE QUESTIONS IN SECTION A *(30 MARKS)*
4. ANSWER THE COMPULSORY QUESTION B1 IN SECTION B, AND SELECT THREE ADDITIONAL QUESTIONS TO ANSWER FROM THE LIST PROVIDED *(70 MARKS)*
5. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS

SECTION A (30 MARKS)

*ANSWER **ALL** QUESTIONS IN THIS SECTION.*

1. Substituting glucose for part of the fat content in a parenteral nutrition admixture lowers the risk of thrombophlebitis and glucose oxidative rate. **True/False (1 Mark)**

2. There is marked risk of micronutrient overdosing with parenteral nutrition administration because the intravenously infused minerals and trace elements by-pass selective absorption by the gut and processing in the kidney. **True/False (1 Mark)**

3. Post pyloric feeding may be conducted by administering enteral feeds via gastro-jejunostomy, nasojejunal or nasoduodenal tubes. **True/False (1 Mark)**

4. Name the two (2) omega-3 fatty acid derivatives **(full names)** found in fish that have anti-thrombotic and anti-inflammatory properties. **(2 Marks)**

5. Approximately how many kg/week of body weight can be gently lost by a moderate reduction in energy intake of 600 kcal/day? **(1 Mark)**

6. What does the phrase "Keep Four the Floor" mean in reference to the dietetic management of glycaemia in diabetic patients? **(1 Mark)**

7. State the recommended sensible drinking limits of alcohol per day for men and women. **(2 Marks)**

8. Briefly explain why excessive alcohol intake increases blood pressure and moderate alcohol intake decreases blood pressure? **(2 Marks)**

9. State the three (3) main food groups by which the Glycaemic Index (Food Exchange List) is classified. **(3 Marks)**

10. Define osteoporosis as per the Royal College of Physicians' definition ***(RCP 2000)***. **(1 Mark)**

11. State the complete diet order that is usually recommended for patients with liver cirrhosis; number of feeds per day inclusive. **(2 Marks)**

12. Why is high salt intake contraindicated in the dietetic management of peptic ulcers? **(1 Mark)**

13. Name the dietary guidelines that have been recommended by the British HIV Association for managing metabolic disorders in HIV patients on highly active antiretroviral therapy (HAART). **(1 Mark)**

14. State three (3) factors that usually contribute to the increment of nutritional requirements in patients suffering from cystic fibrosis. **(3 Marks)**

15. Give two (2) reasons why HIV patients with CD4 count 200 or less need to boil their tap water before consumption? **(2 Marks)**

16. Why are bananas, potatoes and beans clinically contraindicated in the dietetic management of renal failure? **(1 Mark)**

17. State the three (3) feeding infusion rates by which enteral feeds can be administered into the gastrointestinal tract. **(3 Marks)**

18. State the two indicators that are used as criterion for successful weight management in the treatment of overweight and obese individuals. **(2 Marks)**

SECTION B (70 MARKS)

QUESTION B1 IS COMPULSORY. *YOU MUST THEN ANSWER ANY OTHER* ***THREE QUESTIONS*** *OF YOUR CHOICE FROM THE REMAINING FOUR QUESTIONS.*

Question B1: Compulsory Question. (10 Marks)

Case Study:

Mr John Doe is a 29 year old male with decompensated auto-immune liver disease and is malnourished with moderate ascites. He also has jaundice, steatorrhea and is mobile.
Height: 186 cm, Weight: 55 kg (prior ascites drainage)
Moderate ascites estimated to be about 7 litres

Refer to Appendix A (last page) when answering questions B1a and B1b:

a) **Table 1** in **Appendix A** refers to a summary of Schofield equations for the estimation of basal metabolic rate (BMR). Using the appropriate Schofield predictive equation from **Table 1**, estimate Mr Doe's total energy requirements for body weight maintenance and for weight gain. **(4 Marks)**
b) Using the nitrogen figures, in **Table 3**, estimate Mr Doe's daily **total protein** requirements per kg body weight. Express your answer in terms of grams of protein per kg body weight and not in terms of the nitrogen equivalent. **(2 Marks)**
c) Among other dietary restrictions, a "no salt" diet order has been prescribed for Mr Doe. Translate the salt restriction diet order into mmol of dietary sodium equivalent that Mr Doe will be allowed to take per day. **(1 Mark)**
d) State three (3) metabolic risk factors that may make a liver cirrhosis patient be prone to undergoing "accelerated fasting status from a fed state". **(3 Marks)**

Question B2 (20 Marks)

a) Outline the biochemical processes that lead to the formation of an atherosclerotic plaque. Propose a flow sheet to explain your answer. **(5 Marks)**
b) Briefly explain four (4) pro-coronary heart disease risk factors that are associated with dietary habits. **(8 Marks)**
c) Name the dietary guidelines that are recommended for the management of cardiovascular diseases. **(1 Mark)**

d) Outline the six (6) dietetic components of the dietary guidelines indicated above (2c) which pertain to the treatment of **proven cardiovascular disorders** such as coronary heart disease. **(6 Marks)**

Question B3 (20 Marks)

a) The principles of diet formulation dictate that a healthy diet is one that supplies adequate energy and nutrients while preventing the onset of chronic diseases such as type II diabetes mellitus. With the above dietetic principle in mind, define type II diabetes mellitus and explain two (2) dietary factors that could be modified in order to decrease the risk of type II diabetes. **(4 Marks)**

b) Using medical terminologies, state and then define the four (4) general classic symptoms of diabetes mellitus. **(8 Marks)**

c) Briefly explain why consumption of alcohol on an empty stomach is discouraged in diabetic patients, especially those receiving anti-diabetic drugs. **(2 Marks)**

d) A fruity breath is one of the symptoms which is exhibited by a diabetic patient suffering from ketoacidosis:

   i) Define ketoacidosis and name the three metabolites that cause this typical fruity smelling breathe. **(4 Marks)**

   ii) How is diabetic ketoacidosis treated? **(2 Marks)**

Question B4 (20 Marks)

a) Outline metabolic processes of poorly managed advanced chronic renal failure that could ultimately lead to renal bone disease (soft renal bone disease). Propose a flow sheet to explain your answer. **(6 Marks)**

b) Haemodialysis and peritoneal dialysis are renal replacement procedures used to treat kidney failure. Compare and contrast these two dialysis procedures with emphasis on the following factors:

   i) Definition of each dialysis procedure. **(2 Marks)**

   ii) Recommended frequency of dialysis intervals. **(1 Mark)**

   iii) Potential impact of each dialysis procedure on energy and protein requirements; and on serum potassium levels. **(6 Marks)**

c) State a dietetic and pharmaceutical measure that could be employed to keep serum phosphate levels near-normo ranges in the treatment of advanced chronic renal failure. **(2 Marks)**

d) What are the three (3) ways by which excessive salt intake compounds fluid balance problems in individuals suffering from advanced chronic renal failure? **(3 Marks)**

Question B5 (20 Marks)

a) State the three (3) main cancer treatment options. **(3 Marks)**

b) Which cancer treatment option mentioned above (5a) tends to yield gastrointestinal symptoms such as diarrhoea and malabsorption when targeted at the pelvic area and why do these treatment side effects occur? **(3 Marks)**

c) Outline three (3) pre-operative nutritional support guidelines that are recommended by the American Society of Anesthesiologists. **(3 Marks)**

d) State three (3) advantages that are associated with pre-operative carbohydrate and fluid loading of surgical patients prior to the administration of anesthesia. **(3 Marks)**

e) Briefly explain how each one of the following dietary factors is likely to impact bone health and give reasons for your answer: **(8 Marks)**

   i) Vitamin K
   ii) Soyabean isoflavones
   iii) Caffeine
   iv) Excessive alcohol intake

END OF EXAMINATION

APPENDIX A

Useful Data:

Table 1: Schofield Prediction Equations

Age Range (Years)	BMR (kcal/24 hours)	
	Males	Females
10-17	(17.7 x kg body wt) + 657	(13.4 x kg body wt) + 692
18-29	(15.1 x kg body wt) + 692	(14.8 x kg body wt) + 487
30-59	(11.5 x kg body wt) + 873	(8.3 x kg body wt) + 846
60-74	(11.9 x kg body wt) + 700	(9.2 x kg body wt) + 687
75+	(8.4 x kg body wt) + 821	(9.8 x kg body wt) + 624

Table 2: Stress Factors Used in the Estimation of Energy Requirements in Liver Disease

State	Stress Factor (%)
Compensated liver disease	0 - 20
Decompensated liver disease	30 - 40
Acute (fulminant) liver failure +/- ventilation	20 - 30
Post-transplant (post-operative period duration of at least 4 weeks depending on nutritional status)	30

Table 3: Activity Factors Used in the Estimation of Energy Requirements in Liver Disease

State	Activity Factor (%)
Bed-bound/immobile	10
Bed-bound mobile/sitting	15-20
Mobile on ward	25

Table 4: Figures Used to Estimate Nitrogen and Protein Requirements in Liver Disease

State	Nitrogen (g/kg/day)
Compensated cirrhosis	0.2
Decompensated cirrhosis	0.25-0.3
Post transplant	0.25-0.3
Acute (fulminant) liver failure	0.2-0.25

NB: Nitrogen requirements for repletion or weight gain: ≥ 0.3 g N/kg body weight

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

BSc Human Nutrition

Public Health and Nutrition
AGN 4520
2013-2014

Date: Thur 24th July 2014 **Time: 09.00-12.00hrs**

Duration: THREE (3) HOURS **Venue: Other Rooms**

INSTRUCTIONS TO THE CANDIDATES:

1. **THIS PAPER CARRIES 100 MARKS AND HAS TWO SECTIONS, A & B**

2. **ANSWER ALL THE QUESTIONS IN ALL SECTIONS.**

3. **ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS**

Section A: (TOTAL 20 MARKS)

1. Name TWO of the basic requirements for Primary Health Care? **(2 MARKS)**

2. **a.** What criteria can be used to assess causation in research studies? **(1 MARK)**
   b. Name ONE example from this criterion? **(1 MARK)**

3. What is the purpose of a food and nutrition surveillance system? **(2 MARKS)**

4. What does 'Under-coverage' mean in terms of targeting? **(2 MARKS)**

5. Give TWO reasons why a HIV-infected person is more at risk of malnutrition? **(2 MARKS)**

6. Within a Logical Frame, what are the only two things that can be controlled by the project management team? **(2 MARKS)**

7. There are two simple and effective treatments for the clinical management of acute diarrhoea, what are they? **(2 MARKS)**

8. Name TWO potential users of the Zambian Health Information System (HIS) data**? (2 MARKS)**

9. The *'National Food & Nutrition Commission Strategic plan 2011-2015'* outlines nine major nutrition problems in Zambia, name TWO of these? **(2 MARKS)**

10. Name TWO factors that should be included in the framework for evaluating the role of community participation in nutrition programmes? **(2 MARKS)**

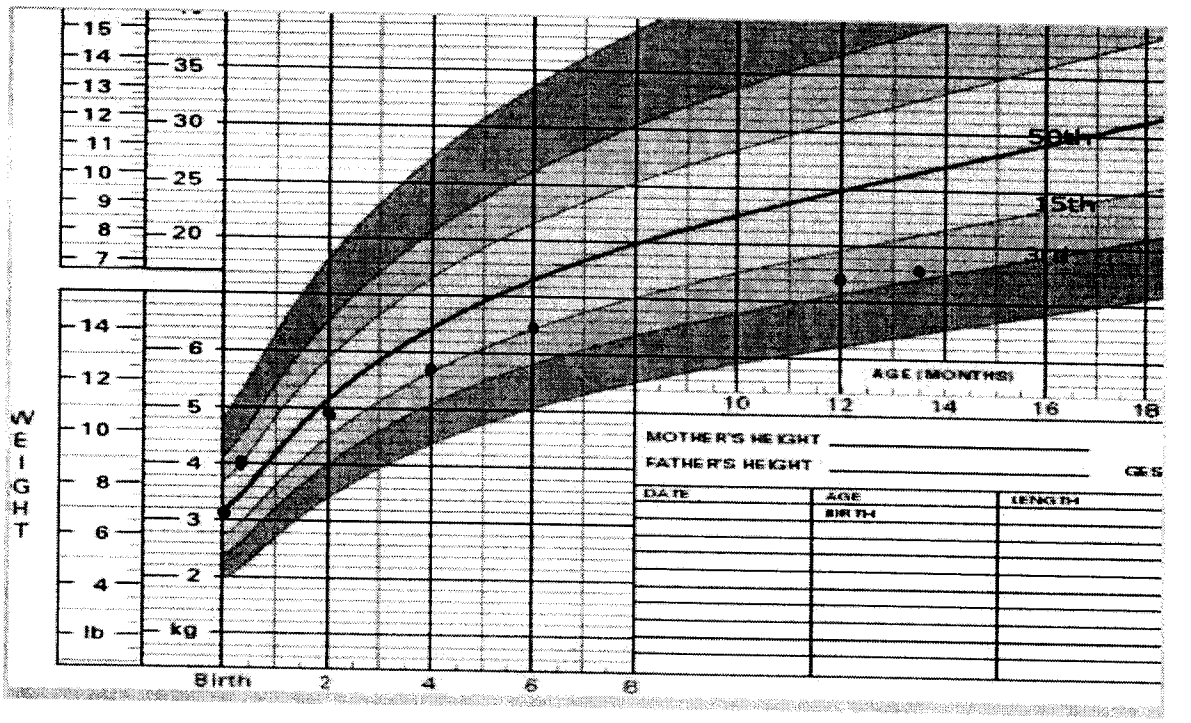
Section B: (TOTAL 80 MARKS)

1. **a.** For the child's weight-for-age growth chart below, briefly describe the pattern of growth in terms of percentiles. **(4 MARKS)**

   b. What course of action would you take from your interpretation of this growth curve? **(5 MARKS)**

   c. Outline THREE pieces of additional information about the child you may wish to consider during your interpretation, and state how this would assist you? **(6 MARKS)**

   d. Discuss the key concerns with using underweight as an indicator of malnutrition in Zambia? **(5 MARKS)**



2. The Lancet 2013 series presents evidence from nutrition-specific interventions that can improve nutritional outcomes for infants and young children.
   a. Outline TWO interventions that have been shown to successfully improve nutritional outcomes in this life-stage. **(4 MARKS)**

   b. For each intervention stated in your answer to question 2a, give details of the nutritional outcomes affected. **(8 MARKS)**

   c. Briefly explain how improving these outcomes would contribute to the reduction of current disease burden in Zambia. **(8 MARKS)**

3. There are several sources of data that feed into the Health Information System (HIS) for Zambia. State the key sources of this data and discuss the current challenges of these in terms of effective food and nutrition surveillance information. **(20 MARKS)**

4. **a.** Briefly outline the THREE approaches to community participation developed by Rifkin to enable planners to view how they approached community participation in their own programs. **(6 MARKS)**

   b. Discuss how community participation can strengthen primary health care in Zambia. **(14 MARKS)**

THE UNIVERSITY OF ZAMBIA

UNIVERSITY FIRST SEMESTER EXAMINATIONS - MARCH 2013

AGS 2011

FUNDAMENTALS OF SOIL SCIENCE

TIME: 3 HOURS **Marks:** 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

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1. Define the following terms: (***15 marks)***

   a. Pedology
   b. Solum
   c. Aphaneretic rock
   d. Silt
   e. Soil Structure
   f. Total density of a soil
   g. Air movement by mass flow
   h. Humus
   i. Physical weathering
   j. Eluviation

2. Indicate whether the following statements are true or false or whether you do not know the answer (***15 marks)***
   (1.5 marks for correct answer, -0.5 marks for wrong answer, and 0 for I don't know).

   a. Podzolization is an example of one of the soil forming processes known as losses.

   b. Weathering by carbonation results in the consumption of carbon dioxide in the soil.

   c. Olivine is a ferromagnesian mineral formed at a higher temperature than quartz.

   d. A soil with a colour code 7.5YR 4/2 is redder and darker than a soil with a colour code 10YR 5/3.

   e. A cubic meter of soil containing 0.26 m^3 of air with a composition similar to the earth's atmosphere contains more than 2 litres of oxygen at 20° C.

f. Soils with aggregated structure usually have a greater proportion of macrospores than soils with similar texture with single grained structure.

g. The oxygen demand will be higher in the cold season than in the hot season for a moist soil with the same organic matter content.

h. A sandy loam is contains more sand than a loamy sand.

i. SiO_2 is harder than $CaCO_3$ and $Ca_5(PO_4)_3F$.

j. The earth's crust contains more Fe than Ca in the earth's crust.

3 Answer the following questions briefly and concisely. ***(35 marks)***

a) List and define any four chemical weathering processes. (5 marks)

b) Soil colour is one of the physical properties used when studying soils. What are the three properties used to define the colour using the Munsell colour codes. Give an example of a colour code indicating what the letters and numbers in the code signify. (5 marks)

c) Soil structure is an important soil property, list and describe the 7 main types of aggregated structure found in soils. (5 marks)

d) A soil profile has horizons designated A,B,C,E and O. Sketch a profile of this soil showing five soil horizons and indicate the locations of the five horizons mentioned . (5 marks)

e) Carbonation is an important chemical weathering process. Write a balanced chemical reaction of the weathering of Muscovite ($KAl_2(Si_3Al)O_{10}(OH)_2$) to kaolinite $Al_2Si_2O_5(OH)_4$ by carbonation. (7.5 marks).

a) Describe some of the beneficial effects of humus on the physical and chemical properties of soils. (7.5 marks)

4 Below is a Table with selected physical and chemical properties of soil from Choma District in Southern Province.

Depth (cm)	Sand (%)	Silt (%)	Clay (%)	ρ_b (g/cm^3)	Org C (%)	N (%)	Og $gH_2O/cm3$
0-19	5.4	7.6	87.0	1.66	0.46	0.036	0.10
19-31	6.0	8.2	85.6	1.65	0.42	0.019	0.14
31-71	18.4	6.1	74.8	1.71	0.15	0.014	0.18

Answer the following questions: (35 marks)

a) Plot the textural class of the top 0-19 cm of the soil on the USDA texture triangle attached on page 4 of your question paper and indicate the name of the textural class the soil. (2 marks)

b) What is the total amount of water present in the top layer of this soil expressed in mm? (3 marks)

c) Assuming the particle density of this soil is 2.65g/cm^3, calculate the total porosity of soil in the second horizon between 19 and 31 cm soil depth. (4 marks).

d) What is the degree of saturation of soil in the third soil horizon (31-71cm) (3 marks)

e) Calculate the mass of sand in a 10 m x 10 m plot of the top layer of this soil. (3 marks)

f) Assuming that the air in the top layer of this soil contains 20 % oxygen by volume, calculate the litres of oxygen present in one hectare of the top layer of this soil. (5 marks)

g) What is the total mass of organic matter in one hectare of the second layer of this soil? (4 marks)

h) Will mineralization occur when organic matter in the top layer of this soil is decomposed by soil microbes? Give reasons to support your answer. (5 marks)

i) Given that the air in the soil surface contains 21 % oxygen (or 0.3kg.m^{-3}) while that at 25cm below the surface contains 15 % oxygen (or 0.21 kg.m^{-3}), in which direction will you expect the oxygen to flow? Give reasons to support your answer. (2)

j) Given that the diffusion coefficient for oxygen in the soil is 1.98x 10^{-5} m^{2}s^{-1}, calculate the rate of diffusion of oxygen through the soil in kg.m^{-2}s^{-1}between the surface of the soil and 25 cm soil depth, using data provided in question (i). (4 marks)

SMILE SOIL SCIENCE IS FUN

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2013-END OF YEAR FINAL EXAMINATIONS

AGS 2110
FUNDAMENTALS OF SOIL SCIENCE

DURATION: 3 hours
INSTRUCTIONS: Answer all Questions **MARKS**: 100

1. Soil Science is a subject that has a great bearing on the sustainable of land for agriculture and other uses. Answer the following questions: **[10 marks]**

a) What is the origin of the word "Soil"?[2]

b) With the beginning of agriculture about 10,000 years ago, man began to view the soil as a "medium of plant growth". Describe the soil properties that lend support to this view. [4]

c) What exact concepts did the father of Soil Science, Dokuchaev contribute to the discipline? [4]

2 Indicate whether the following statements are true or false. **[10 marks]**

a) A cubic metre of dry soil with a bulk density of 1.65g/cm^3 and a particle density of 2.65g/cm^3 cannot contain more than 0.5 m^3 of oxygen if the soil air contains 18 % oxygen.

b) A soil with a colour code 2.5 YR2/5 is redder and darker than soils with a colour code of 10YR 4/6.

c) The fertilizer $(NH_4)_2HPO_4$ is a compound fertilizer that contains more N and P than Compound D fertilizer (10:20:10).

d) Soil water always flows from a region of higher matric potential to a region of lower matric potential.

e) A soil with a CEC of 7.5 cmol (+)/kg containing 54 mg of Na+/kg soil as exchangeable sodium cannot be sodic.

f) Vaterite ($CaCO_3$) has a higher Neutralizing Value than Magnesite ($MgCO_3$).

g) More energy is required to extract water from soil with a relative humidity of 90% at 25°C than is required to extract water from a 5.0M aqueous solution of NaCl at the same temperature.

h) A loamy sand contains more sand than a sandy loam.

i) A kaolinitic clay dominated by exchangeable aluminium is likely to have more stable aggregates than a smectitic clay dominated with exchangeable sodium.

j) When liming acid soils to neutral pH, more lime is usually required to neutralize the non exchangeable acidity than is required to neutralize the active acidity.

3 Answer the following questions briefly and concisely: **[20 marks]**

a) Describe the similarities and differences between organic matter decomposition and weathering. [6]

b) Describe some important products of weathering. [4]

c) Define the terms soil texture and soil structure, and clearly state the differences. [4]

d) List some cementing agents of primary soil particles and explain the mechanism of cementation. [6]

4 The management of soils requires a good understanding of a number of physical and chemical properties of soils. Answer the following questions: **[20 marks]**

a) Show that a soil with a bulk density of 1400 kg m^{-3} to a depth of 20 cm has a weight of 2.8×10^3 tons per hectare. [6 marks]

b) What is the approximate pH of 0.008 M H_2SO_4? [4 marks]

c) What is the oxidation number of N in NO_3^-, NO_2^-, NH_4^+ and NH_3? [3 marks]

d) What weight of oven-dry soil is obtained from 10 g of air-dry soil containing 7.23 % moisture on a gravimetric basis? [4 marks]

e) Calculate the volumetric water content of the soil above in (d) given that the bulk density is 1400 kg per m^3. [3 marks]

5 Answer the following questions briefly and concisely: **[10 marks]**

i. Discuss any five chemical properties of the soil that have an influence of the double layer thickness of soil colloids and describe how each of these affects the stability of soil aggregates. [5 marks]

ii. List and define the main components of the total water potential of a saturated soil. [5 marks]

6 The top soil of a field from a Farm in Masaiti District of the Copperbelt Province has the following physical and chemical properties.

Depth (cm)	pH 0.01MCaCl$_2$	Org C (.....%.....)	Total N	Avail-P (mg/kg)	Bd (g.cm^{-3})	Al^{3+} (... cmol(+)/kgsoil.....)	K^+	ECEC	CEC_{pH7}	Clay (%)	FC (-gH$_2$O/g soil)	PWP
0-20	4.7	1.48	0.086	5.45	1.23	0.8	0.1	4.1	9.71	35.2	0.232	0.165

FC= field capacity, PWP = permanent wilting point

Answer the following: **[30 marks]**

a. Is nitrogen likely to be mineralized when the organic matter in this soil decomposes? Show the necessary calculations to support your answer. (2 marks)

b. What percentage of the charge of the CEC measured at pH 7 is due to organic matter? (2.5 marks)

c. What is the apparent CEC of this soil and the most likely dominant clay type in this soil? Show calculations to support your answer. (2.5 marks)

d. If a farmer wants to grow a crop that requires 120 kg N/ha, 50 kgP_2O_5/ha and 70 kg K_2O/ha, would **a hectare** of this soil be able to meet the requirements of N, P and K for this crop, given that only 3 % of total N is mineralized in one season, and that only 50% of the P and K available in the soils can be taken up by the crop in one season? Show calculations to support your answer. (5 marks)

e. How many 50 kg bags of Urea, (46:0:0), Compound D (10:20:10) and Muriate of Potash (MOP) (0:0:60) would be required to meet the shortfall of N,P and K supplied by the soil for the above crop **on a 2 hectare plot** given the following conditions: (i) Compound D should meet all the P requirement not met by the soil (ii) any N, not supplied by soils or compound D should be supplied by Urea and (iii) any K not supplied by the soil or compound D should be supplied by MOP. (6 marks)

f. How many 50 kg bags of lime with a neutralizing value of 86 % would be required to neutralize all the exchangeable Al in the top soil **of a 5 hectare plot** with the above topsoil assuming the lime requirement is determined using a factor of 2 x Exch Al. (4 marks)

g. If the above topsoil initially contained 5 % moisture on a gravimetric basis, to what depth will it be wetted by 20 mm of rainfall? (4 marks)

h. What will be the volume of gaseous nitrogen in cubic metres in the top layer of a 1 Lima plot of this soil when it is at field capacity, given that soil air contains 78 % nitrogen? (4 marks)

Note: Useful Atomic masses and constants: K=39g, P=31g, N=14g, O=16g, H=1g, R=4.3145J.mol^{-1}.k^{-1}.

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
UNIVERSITY FINAL EXAMINATIONS-JULY, 2014

AGS 3312
SOIL PHYSICS

Time: Three (3) Hours **Total Marks:** 100
Instruction: Answer all Questions
Non-programmable calculators are allowed

1. Mechanical analysis is a traditional name of the procedure for determining particle size distribution of a soil sample ***(15 marks)***

   a) Briefly describe the procedure involved in the analysis *(9 marks)*
   b) Explain the assumptions made for the application of Stoke's law *(6 marks)*

2. The relationship between matric potential and soil wetness can be explained by sorption and desorption processes associated with the phenomenon of hysteresis. Explain briefly: ***(20 marks)***

   a) The causes of hysteresis? *(8 marks)*
   b) The effect of texture on soil water retention *(4 marks)*
   c) The four commonly used points on the soil water retention curve *(8 marks)*

3. Describe the Neutron Scattering method used in monitoring soil moisture profile and in your discussion include: ***(18 marks)***

   a) Theoretical basis for its application *(8 marks)*
   b) How the calibration is handled *(5 marks)*
   c) Advantages and disadvantages *(5 marks)*

4. Soil temperature strongly affects the rate of physical, chemical and biological activity in soil. The flow of heat into and out of the soil takes place at the soil surface where significant heat exchange occurs ***(12 marks)***

   a) Briefly describe the transport processes of heat within the soil *(6 marks)*
   b) Define the three important thermal properties of the soil *(6 marks)*

5. A soil column contains 40 cm of dry sand over 20 cm of dry clay loam soil. Both ends are attached to a constant temperature source with the top maintained at 25°C and the bottom at 4°C. If the thermal conductivity of sand (K_{Ts}) is 0.5 cal^{-1} s^{-1} $°C^{-1}$ and that of clay loam (K_{Tcl}) is 0.25 cal^{-1} s^{-1} $°C^{-1}$, when steady state heat flow and thermal gradient are established, calculate: ***(15 marks)***

   a) The effective thermal conductivity of the soil column *(5 marks)*
   b) The steady state heat flux (q_h) through the two layers *(5 marks)*
   c) The temperature at the sand-loam interface *(5 marks)*

6. A soil in a greenhouse experiment has a wet bulk density of 1.7 g cm^{-3} and dry bulk density of 1.4 g cm^{-3}, calculate: ***(20 marks)***

   a) Gravimetric moisture content (%) *(5 marks)*
   b) Volumetric moisture content (%) *(5 marks)*
   c) Air-filled porosity (%) *(5 marks)*
   d) New air-filled porosity (%) if a 2 cm of irrigation is applied and penetrates to a soil depth of 25 cm *(5 marks)*

End of Exam

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

END OF YEAR FINAL EXAMINATIONS – JULY 2013
AGS 4210 – SOIL MINERALOGY AND CHEMISTRY

DURATION: 3 hours **MARKS**: 100
INSTRUCTIONS: Answer all questions

Some useful information: Atomic masses: C=12g, N=14g, P=31g, O=16g, K=39g, H=1g, Ca=40g, Si=28g Mg=24g Al=27g.

1. Gypsum is used as a soil amendment and source of nutrients for crop production. The crystallographic properties of gypsum are given below:
   α= 1.519, β=1.523 , γ=1.1529
   a=5.68Å, b=15.18Å c=6.29Å,
   α=90°, β=113.83°, γ=90°, ρ=2.3g/cm^3
   Answer the following questions: **[10 marks]**
   a) To which crystal system does gypsum belong? Give reasons to support your answer. **[2.0]**
   b) Can a crystal of gypsum polarize ordinary light? Give reasons to support your answer. **[2.0]**
   c) What is the axial ratio of gypsum? **[2.0]**
   d) In which density fraction would gypsum occur upon separation using bromoform (sg=2.89g.cm^{-3}) as the separating fluid. Give reasons to support your answer. **[2.0]**
   e) If a crystal of gypsum is adjacent to a crystal of Fluorite (CaF_2) (n=1.433) towards which mineral will the becke-line move in a thin section of the sample when the sample is brought out of focus. **[2.0]**

2. Agricultural lime is an important soil amendment for remedying soil acidity. In Zambia, there are limited deposits of carbonate rocks that can be used as sources of agricultural lime. A study was carried out on the composition of carbonate rocks in Luapula Province to assess their suitability for use as agricultural lime. The common minerals in carbonate rocks are calcite and dolomite. The major X-ray diffraction peaks for these minerals are given below:

Calcite		Dolomite	
Intensity	d(Å)	Intensity	d(Å)
100	3.04	100	2.89
14	2.50	19	2.19
18	2.29	10	2.02
16	2.10	13	1.78

Attached is a diffractogram of the analysis the carbonate rock from Matanda Village in Luapula Province. The analysis was carried out using a Diffractometer that used CuK_α radiation with λ=1.5418 Å.

Answer the following: **[15 marks]**

a) Calculate the d-spacings corresponding to the 4 prominent peaks on this diffractogram labelled 1, to 4. **([4]**

b) Identify the carbonate mineral/s present in this carbonate rock. Give reasons to support your answer. **[2]**

c) If a Thermal Gravimetric Analysis of 95 mg of this sample shows a weight loss of 40 mg between 40 and 1000°C corresponding to the loss of CO_2 gas from the sample. Assuming the mineral you identified by X-ray diffraction analysis is the only mineral that releases CO_2, calculate the percentage of this mineral in the sample. **[5]**

d) Based on the answer obtained from question(c) above, calculate the amount of this ground carbonate rock that you would require to neutralize the acidity of a soil whose lime requirement is given as 2.5 metric tonnes per hectare? **[4]**

3. Silicates are the most abundant minerals in most mineral soils. The following are chemical formula of minerals that commonly occur in soils: SiO_2, $KAl(AlSi_3)O_{10}(OH)_2$, $K(AlS_3)O_8$, $Al_2Si_2O_5(OH)_4$. Answer the following: **[25 marks]**

   a) Name the four minerals whose formulae are given above and indicate whether they are primary or secondary minerals. **[3]**

   b) In which of the above minerals does isomorphus substitution occur? Indicate the elements involved in the substitution. **[2]**

   c) Two common layer silicate minerals in soils are $Al_2Si_2O_5(OH)_4$ and $Na_{0.4}Al(Al_{0.4}Si_{3.6})O_{10}(OH)_2$.

   Answer the following:

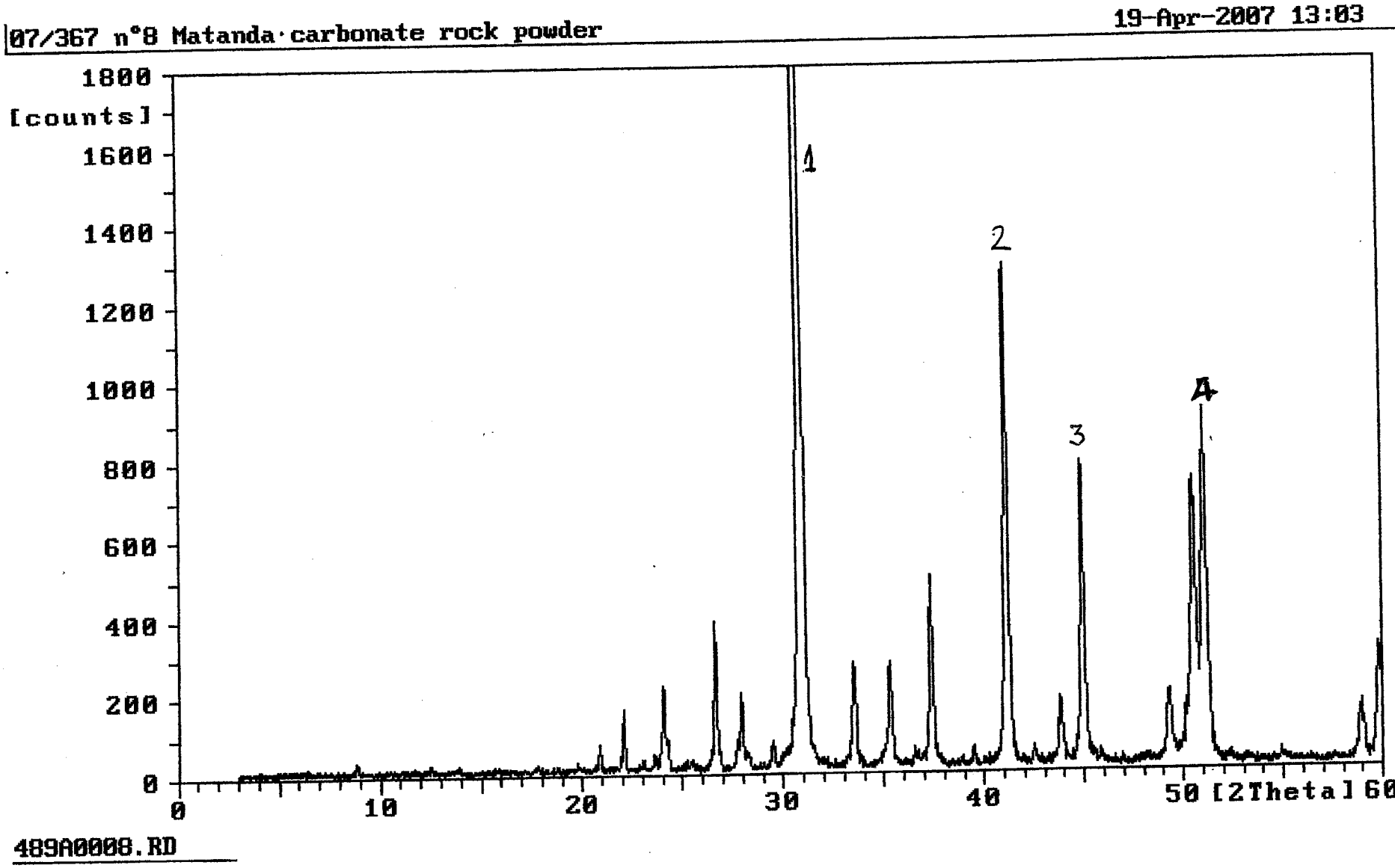
   (i) What are the names of these two minerals? **[2.0]**

   (ii) Draw a schematic diagram of each of these two minerals, indicating the planes in which each of the elements in the formula occurs. **(6 marks)**

   (iii) Describe the physical and chemical properties of the two minerals, with reference to their (i) sources of charge, (ii) magnitude of the CEC, (iii) the specific surface area, and capacity to contract and expand upon wetting and drying. Relate these properties to the structure of the minerals. **[6]**

   (iv) A silt sample of a soil contains SiO_2, $KAl_2(AlSi_3)O_{10}(OH)_2$ and $Al_2Si_2O_5(OH)_4$. Results of a Thermal Gravimetric Analysis of 100 mg of the sample indicated a weight loss of 6 mg at 550°C, and a chemical analysis of the silt fraction shows that it contains 2.5 % K.

Diffractogram for Question 2



Assuming all the K is associated with muscovite, calculate the percentages of quartz, kaolinite and mica in the silt fraction of this soil. **[6]**

4. Answer the following questions briefly and concisely: **(20 marks):**

   a) Explain the basis for using "Alum" or $Al_2(SO_4)_3$ to clarify potable water [3]
   b) Assuming layer silicates and organic matter exist independently in soil, calculate the typical CEC of a soil containing 40 % montmorillonite, 30 % kaolinite and 3 % organic matter. [5]
   c) Determine the probable clay mineral type for a soil that contains 35 % clay, 50 % sand and 15 % silt and exhibits a CEC of 24cmol(+).kg^{-1}. [5]

   d) Define the term "fixation" as used in Soil Science and then distinguish K from P fixation [5]
   e) Two different waters were used to leach a soil. From one soil, 20cm^3 was collected in 20 min while in the other it took over an hour to collect the same volume. Explain the results. [5]

5. Organic matter plays an important role in the functioning of soils. Answer the following: **[10 marks]**
   a) List six functional groups responsible for charge development in humus **[5]**

   b) Explain why only a few percentage of organic matter in the soil can have such a profound effect on soil properties. **[2]**

   c) Explain precisely why the following chemical processes lead to weathering of rocks and minerals: Hydrolysis, hydration, oxidation/reduction **[3]**

6. The soil solution is the medium in which most chemical reactions occur. Answer the following questions. **[20 marks]**
   a) Estimate the EC ($\mu S\ cm^{-1}$) of a soil extract whose chemical composition is 4.0 mg Ca^{++}, 1.2 mg Mg^{++}, 2.34 mg K^+ and 0.3 mg Na^+ per litre. **[5]**

   b) Explain the significance of using activities ( ) rather than simply concentration [ ] in describing chemical Equilibria. [10]

   c) Describe the mechanism of pH-buffering in the region of pH <4.0 **[5]**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY FIRST HALF ACADEMIC YEAR EXAMINATIONS – MARCH 2014

AGS 4221
SOIL AND PLANT ANALYSIS

TIME: 3 HOURS Marks: 100
INSTRUCTIONS: **ANSWER ALL QUESTIONS AND WRITE LEGIBLY**

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1. Discuss the importance of soil test correlation and soil test calibration in the development of soil test methods. [10 Marks]

2. Discuss the importance of plant analysis in agriculture, clearly stating reasons why it is so important. [20 Marks]

3. There is a relationship between nutrient supply, plant nutrient concentration and plant yield.

    a. Discuss the relationship between nutrient supply to the soil, nutrient concentration in the plant and the yield of a particular crop. [6 Marks]
    b. Explain why the above relationship is important as a basis for plant analysis. [4 Marks]

4. A good understanding of the intensity, quantity and capacity factors of nutrient availability in the soil is important.

    a. Define intensity, quantity and capacity factors. [6 Marks]

    b. Why are strong acids are not used as extractants for "available nutrients"? [4 Marks]
    c. What are the important aspects to consider when developing an extraction method for a particular element? [4 Marks]
    d. What role does NH_4^+ ion in the Ammonium acetate solution used in the extraction of exchangeable bases play? [6 Marks]

5. To determine the K content in a fertilizer, 1 g of the sample was dissolved in 100 ml of distilled water. The solution was then filtered into a 250 ml volumetric flask and filled to the mark with distilled water. 1 ml was then carefully transferred into an empty 250 ml volumetric flask and then filled with distilled water up to the 250 ml mark. This sample was then analysed for potassium (K) using an Atomic Absorption Spectrophotometer which gave a reading of 3.99 mg/l.

    a. Calculate the amount of potassium in the fertilizer sample and express your answer as % K and % K_2O. [10 Marks]

b. Given that a farmer wants to grow a maize crop that requires 105 kg K_2O/ha and that the potassium content in the soil on his piece of land is 23 mgK/kg.
   i. Calculate the potassium deficit in the soil in meq/100g soil. [4 Marks]
   ii. How much of the above fertilizer in (a) should he apply to a 1 ha plot to adequately supply K. Assume a soil bulk density of 1.3 g/cm^3 and a soil depth of 20 cm. [6 Marks]

6. In order to raise soil pH from 4.3 to 5.2 to precipitate the exchangeable aluminium in the soil, an agricultural extension officer equilibrated 10 g of soil in 15 ml of 0.02 *M* $Ca(OH)_2$ for a period of two weeks. How much lime does this represent in tons $CaCO_3$/ha if the effective calcium carbonate equivalence of the $Ca(OH)_2$ is 84%? Assume a soil bulk density of 1.3g/cm^3 and a depth of 20 cm. [10 Marks]

7. Given the following information: Atomic masses of H=1, Na=23, Ca=40, K=39, Cl=35.5, O=16 and P=31.

   a. What is the percent concentration of a solution made of 25g $CaCl_2$ dissolved in a final volume of 450 mls? [2 Marks]
   b. What is the molar concentration of 10g of NaCl dissolved in 100 ml water? [2 Marks]
   c. Calculate the amount of NaCl required to prepare half a litre of a 0.05 M NaCl solution. [2 Marks]
   d. If one dissolves 2.0 g of Dipotassium phosphate (K_2HPO_4) into one (1) litre of water, what are the concentrations of K and P ions in the solution in ppm; show the steps of the calculation. [4 Marks]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE
UNIVERSITY EXAMINATIONS: JULY/AUGUST 2014

AGS 4232: Soil Fertility and Amendments

TIME: 3 HOURS MARKS: 100

INTSRUCTIONS: ANSWER ALL QUESTIONS

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1. Elaborate on the two broad approaches or strategies to address the observed decline in fertility and productivity of Zambian soils. [10]

2. Examine the following soil analytical data and answer the questions that follow:

Depth, cm	pH	Exchangeable cations, cmol kg^{-1} soil						Avail. P, ppm	Soil Organic matter, %	Bulk density, kg m^{-3}
		Al^{+++}	H^{+}	Ca^{++}	Mg^{++}	K^{+}	Na^{+}			
0-20	4.03	0.24	0.07	0.85	0.04	0.11	0.06	2.21	0.80	1400

a). Describe the major constraints to crop production on this soil? [10]

b). What amendments and specific amounts in kg ha^{-1} should be applied to this soil in order to bring it to reasonable productivity? [10]

c). Determine the amount of P that would be fixed by Al^{3+} in this soil [5]

3. a). Given that a 5-ton ha^{-1} crop of maize transpired 3.2×10^{9} g of water per season and the average P concentration in the soil solution was 0.2 mg dm^{-3} and adequate P in the plant is 0.2 % in the dry matter, determine if mass flow supplied adequate P to meet the crop requirement. [6]

b). Given that the diffusion coefficient of P in a humid soil is 5.0×10^{-9} $cm^2 s^{-1}$, how far from the placed fertilizer granule would the P have moved in 6 hours? [4]

4. a). What is meant by nutrient fixation in soil and clearly distinguish between K and P fixation. [6]

   b). Explain why application of lime alone, organic matter alone or a combination of the two to an acid soil enhances the release of fixed P that benefits crop growth. [5]

   c). Given that a secondary mineral, di-calcium phosphate ($CaHPO_4^\circ$ with a solubility product constant pK = 2.41) controls the P concentration in a soil, calculate the concentration of phosphate in equilibrium with a soil solution in which the Ca concentration is 0.01 M. [6]

5. Pure forms of humus, montmorillonite, kaolinite and sesquioxides have average cation exchange capacity (CEC) values of 200, 80, 15 and 5 cmol kg^{-1} respectively. Calculate the estimated CEC of a soil containing 3 % humified organic matter and 30 %, 20 % and 42 % of montmorillonite, kaolinite and sesquioxides respectively. [10]

6. a). Given that Ammonium Sulphate (21 % N and 24 % S), Urea, Triple super phosphate (46 % P_2O_5) and Muriate of potash, KCl (60 % K_2O) can be compatibly dry-blended, demonstrate how to make a blend fertilizer of grade 10 : 20 : 10 + 5 % S. [10]

   b). Demonstrate by use of equations the reactions of agricultural lime in an acid soil and describe the changes in soil chemical properties that occur following liming [8]

   c). How much agricultural lime should be applied to a field that has been ripped in rows 90 cm apart in order to obtain a rate of 3 ton ha^{-1} under conventional tillage where it is broadcast? [5]

   d). Describe the reactions in the amendment of a salt-affected soil using gypsum [5]

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE

AGS 511: SOIL CHEMISTRY

EXAMINATIONS FOR 2013/2014 FIRST HALF ACADEMIC YEAR

February-March, 2014

MARKS: 100 MARKS **TIME: 3 HOURS**

INSTRUCTIONS: Answer all questions legibly and as comprehensively as possible. Shorthand in text is not permitted and calculations must show all important steps

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1. a). Define the terms "mineral", "primary mineral" and "secondary mineral" and give two examples of each of primary mineral and secondary minerals. [4]
   b). Since nutrient elements are principally absorbed in oxidized state, list the cultural practices that ensure good aeration of soil at all times. [3]
   c). What fractions or pools of soil nutrients are considered plant available and why? [2]

2. a).Define the term "colloid", give two of its most important characteristics and list soil colloids that control soil chemical properties. [6]

   b). A hydrous iron oxide colloid (constant potential, or reversible surface) has a surface potential of 120 mV in an aquatic environment of pH 6:

   i) Calculate the pzc of the colloidal particle [5]

   ii). If the pH of the solution increased from 6 to 7, what effect would this have on the adsorption of anions and cations [3]

   c). Twenty grams (20 g) of soil were extracted with 1.0 M neutral NH_{4Aoc} solution to exchange bases from the exchange complex and a second sample of 20 g was extracted

with 1 M KCl to extract acid ions. The following cations were extracted: Ca = 0.02 g; Mg = 0.006 g; K = 0.117 g; Al =0.007 g and H = 0.00001 g. Calculate the ECEC, base saturation % and acid saturation %. [10]

3. a). Demonstrate by use of reaction equations the reactions of agricultural lime in an acid soil and describe the changes in soil chemical properties that occur following liming. [6]

b).An acid soil with a ECEC of 15 cmol (+) kg^{-1} tested 0.35 cmol kg^{-1} with respect to exchangeable Al^{3+}. How much agricultural lime of only 60 % purity should be applied to replace all the Al^{3+} and ameliorate the soil acidity problem in the 15 cm deep layer per ha given that the soil has a bulk density of 1400 kg m^{-3}? [6]

c).The critical limit of exchangeable K in soil by the ammonium acetate extraction procedure is 0.22 cmol kg^{-1}. Calculate the equivalent amounts of K and K_2O equivalent per ha in the 20 cm depth of soil given that the soil bulk density is 1400 kg m^{-3}. [5]

4. a).Explain the major differences between the treatment of ion adsorption according to the Langmuir and Freundlich models. [5]

b). The Langmuir model was developed for solid-gas adsorption. Explain the rationale for application of this model to solid-solution adsorption such as the soil system. [5]

5. a). Describe how climate as a soil-forming factor influences soil development. [6]

b) Why would a soil developed from limestone (alkaline) turn out to be acid when the soil is fully developed? [4]

6. a). Explain the mechanisms of K and P fixation in soil [6]

b) Describe the implications of a). above on fertilizer application to soil [4]

7. In checking out an aerial application of ammonium sulphate fertilizer (21 % N) to a hectare of his field, a farmer collected 2.0g of fertilizer in an 8-inch diameter bucket placed in his field. Calculate the rate of N fertilizer (kg N ha^{-1}) that this application rate indicates. [10]

8. In a conservation farming system, crop rotation with legumes adds 5 ton of residue containing 3.5 % N of which 85 % is potentially mineralizable at the rate of 0.135 $week^{-1}$. Calculate the amount of N that would be mineralized during 120-day growing cycle of maize in Zambia. [10]

END

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – JULY 2014

AGS 522
SOIL AND PLANT ANALYSIS

TIME: 3 HOURS Marks: 100

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

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1. The quality of results from Soil and Plant analysis laboratory depend to a large extent on the sampling quality. Answer the following questions: **(20 marks)**

    a. Briefly discuss the importance and how to achieve the concepts of:
        i. Maximizing sample representativeness of the field being sampled. (4 Marks)
        ii. Minimizing sample contamination. (4 Marks)
    b. Briefly describe how you would take a good diagnostic plant sample stating the most important issues to bear in mind. (5 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. (5 Marks)

2. Many methods are employed in interpreting soil and plant test results to make recommendations , answer the following: **(12 marks)**

    a. Describe the Cate-Nelson method of setting a critical nutrient concentration. (4 Marks)
    b. Fertilizer recommendations can be made either by following the philosophy of fertilizing the soil or the philosophy of fertilizing the crop.
        i. Discuss the importance of soil and plant analysis in relation to the two (2) philosophies. (4 Marks)
        ii. State the advantages and disadvantages of these two (2) philosophies? (4 Marks)

3. The Bray-1 method is commonly used for determining plant extractable Phosphorus in soil. Based on your understanding of this method, answer the following questions: **(14 marks)**

    a. Explain the principle behind this method and state the soil conditions for which it is most appropriate. (3 marks)
    b. What fraction(s) of soil P can be extracted using the above method? (2 marks)
    c. Give the composition of reagents in the Bray-1 extracting solution and indicate the purpose of each reagent. (4 marks)
    d. Determine the concentration of P in a soil extract in mg/L, whose absorbance is 0.654, given that two standards with concentrations of 0.0 mg P/L and 1.0 mg P/L have absorbancies of 0.00 and 0.840 respectively. (5 marks)

4. The use of organic fertilizers is one of the key principles of Integrated Soil Fertility Management especially in regions with rapidly declining soil fertility. You have been contracted to determine the total nitrogen and cationic micronutrients contents of an organic fertilizer that has 5% organic carbon in its dry matter. Answer the following questions: **(19 marks)**

    a. Describe how you would determine the nitrogen content of the material and clearly state the principal reagents you would use and their role in the analysis. (10 marks)

b. Name any four cationic micronutrients and describe how they are extracted from organic materials. (5 marks)

c. How does the extraction of cationic micronutrients differ from that of boron? (2 marks)

d. How do organic amendments improve the availability of cationic micronutrients in soils? (2 marks)

5. How much lime with a neutralizing value of 90% is required to completely neutralize the exchangeable acidity in the top 20 cm depth in a hectare of a cotton field in Mungwi District that has soil with an ECEC of 10 cmol+kg^{-1}, a bulk density of 1.4 g/cm^3 and exchangeable acidity of 60 % of the ECEC? **(10 marks)**

6. You have joined a consulting firm dealing with soil testing for environmental and agricultural use. Among your responsibilities is the interpretation of data from the laboratory for use by clients. Your superior has left you with the following assignments. **(25 marks)**

(a) A sample obtained from Kabwe in an area suspected to be polluted with lead was tested using the following procedure. A 1.0-g air dry sample was placed in a 25 mL digestion tube to which 4 M HNO_3 was added and the tube was then covered with a glass funnel. After digestion for 16 hours at 80°C the sample was cooled and the total volume of the digest was brought to 35 mL with de-ionized water. After filtering, 5 mL of the aliquot was placed into a 25 mL volumetric flask that was filled to volume with de-ionized water. The diluted sample was analyzed for Pb by Inductively Coupled Plasma (ICP) and the concentration of Pb was found to be 0.79 mg Pb/L. If uncontaminated soils in the region has a normal distribution of Pb with a mean concentration of 21 mg Pb/kg soil with a standard deviation of 8 mg Pb/kg of soil, determine whether or not the sample that was tested is contaminated with Pb. Show all calculations to support your answer. (7.5 marks)

(b) A client wants to find out if it is worth investing in precision P fertilizer application. He randomly sampled a 5 hectare plot and obtained the following 10 values of Bray-1 extractable P in mg/kg soil. 2.87, 7.11, 5.74, 4.82, 76.62, 31.50, 5.89, 16.95, 19.72, and 43.94.

Answer the following:

(i) If precision P fertilizer application is only justified in fields where the available P is highly heterogeneous, would you recommend the client to consider using precision P fertilizer application for this field, based on the data given? Show the necessary calculations to support your answer. (5 marks)

(ii) Summarize the data of available P in terms of the mean, standard deviation, median, lower and upper quartiles, inner and outer fences of the interquartile range and indicate whether this data has any outliers. (7.5 marks)

(iii) What would be the laboratory costs for estimating the mean value of Bray-1 extractable P in this field at 95 % level of confidence (Note: $Z_{0.05}$ =1.96) with an allowable error of 1.5 mg P/kg soil, given that the cost for determining Bray-1 P is K35.00 per sample? (5 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY MID-TERM EXAMINATIONS – MARCH 2014

AGS 531

LAND EVALUATION AND IMPROVEMENT

TIME: **THREE (3) HOURS**

INSTRUCTIONS: **ANSWER ALL QUESTIONS**

TOTAL MARKS: **70**

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1. A highly mechanized farm in Solwezi (Region III) has been under production of annual crops with high annual fertilizer inputs for the past twenty (20) years. The yields have since declined to about 50% of what they were in the first ten (10) years of production and the farmer is now barely breaking-even on his seasonal investments:

   (a) Give a detailed account of the likely causes of this decline in yields (5 marks)

   (b) What management practices should the farmer have adopted to sustain land productivity from the very outset to avoid the constraints identified in (a) above (5 marks)

2. (a) You have been contracted by Government to conduct a land evaluation study of a 600ha farm earmarked for resettlement of farmers. Give a detailed account of the methodology you would follow from inception of the study to presentation of your report (7 marks)

   (b) A farm in Region III of Zambia has seemingly very good natural grazing for beef and dairy production but experiencing low productivity. Discuss the likely causes of this and propose measures to improve productivity of the land for the same. (3 marks)

3. (a) Give a comparative analysis of the advantages and disadvantages of customary and leasehold tenure with respect to land use for agricultural purposes in Zambia. (5 marks)

(b) Give at least ten (10) basic characteristics of the Zambian Land Evaluation System. (5 marks)

4. Table 1 presents the chemical analytical data from a soil in Chongwe (Region II):

(a) Calculate the following:

i. Cation Exchange Capacity (CEC in cmol kg^{-1}) (1 mark)
ii. Base saturation (1 mark)
iii. Exchangeable acidity (1 mark)
iv. Aluminium saturation (1 mark)
v. Exchangeable sodium (1 mark)

(b) Describe the chemical fertility status of this soil and make recommendations on improving its productivity for annual crops (5 marks)

5. (a) In the layman's language the terms "heavy" and "light" soils relate to the ease and difficulty of tillage. Explain the relationship of these terms to specific soil properties. (5 marks)

(c) Explain how minimum tillage enhances the physical fertility of soils? (5 marks)

6. Tables 2 and 3 present the Land Qualities of land mapping units and Minimum Requirements of selected types of produce.

(a) Determine the suitability sub-classes for the different types of produce on the different land mapping units, present your results in tabular form (7 marks)

(b) From your results in (a) above, recommend a sustainable farming system (land use plan) for the area and justify your recommendation (3 marks)

7. The Land Evaluation and Site Assessment (LESA) is a point-based approach used for rating the value of agricultural land resources. Using the information provided in Tables 4 and 5 below, answer the questions that follow:

Factor	**Factor rating (0- 100 points)**
Protected resource lands	63
Surrounding agricultural lands	38
Water resource availability	71
Project size	30
Land capability class	40
Storie Index	61

a) What is the weighted factor rating for each factor in the LESA model? (3 marks)

b) Determine the total LESA score for the project area (3 marks)

c) What is the scoring decision for the project? (2 marks)

d) What is the main weakness of LESA as a model for rating agricultural land resources? (2 marks)

END OF EXAMINATION

Table 1:

pH (0.01M $CaCl_2$)	Available P mg kg^{-1} (Bray 1)	Exchangeable Cations (mg kg^{-1}) (NH_4OAc pH 7)					
5.6	5.1	Ca^{2+}	Mg^{2+}	K^+	Al^{3+}	H^+	Na^+
		1000	384	54.6	27	7.0	69

Table 2: Land qualities of the mapping units

Mapping unit	Moisture availability (m)	Nutrient availability (na)	Nutrient retention (nr)	Oxygen availability (o)	Land workability (w)	Erosion hazard (e)	Flood hazard (f)
Cn (50ha)	2	2	3	2	2	1	2
Cp (25ha)	3	2	2	2	3	2	1
Cx (65ha)	1	3	3	1	1	1	1
Cy (250ha)	3	3	3	3	3	2	3

Table 3: Minimum requirements of types of produce

Type of produce	Moisture availability (m)	Nutrient availability (na)	Nutrient retention (nr)	Oxygen availability (o)	Land workability (w)	Erosion hazard (e)	Flood hazard (f)
Maize	2	2	2	2	2	2	1
Soyabean	2	2	2	1	2	2	1
Potato	2	2	3	2	3	2	1
Rhodes grass	3	3	3	3	3	2	4

Table 4: Numeric conversion of Land Capability Classification (LCC) units

LCC	Rating
I	100
IIe	90
IIs.w	80
IIIe	70
IIIs.w	60
IVe	50
IVs.w	40
V	30
VI	20
VII	10
VIII	0

Table 5: LESA Model Scoring Thresholds

Total LESA Score	Scoring Decision
0-39	Not considered significant
40-59	Considered significant **only** if LE AND SA sub-scores are each **greater** than or equal to 20 points
60-79	Considered significant **unless** either LE **or** SA sub-score is less than 20 points
80-100	Considered significant

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE

AGS 551: IRRIGATION SYSTEMS

EXAMINATIONS FOR 2013/2014 FIRST HALF ACADEMIC YEAR

ANSWER ALL QUESTIONS TIME: 3 HOURS
MARKS: ALL QUESTIONS 10 MARKS

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Q1. When irrigation of crops is considered necessary, data collection is one of the first things considered and done. Among the important data necessary is the determination of water requirements.

Explain in a step by step manner how irrigation water requirement are determined. In explaining also, explain the weather factor which influence the final figure. Assume that the data you are working with is from a Class A Pan of the US weather Bureau.

Q2. Water is driven by pumps in most irrigation systems. These pumps are characterized by five parameters. Name the five describing what each is and how it is determined. Give the basic equations when needed.

Q3. When a sprinkler system has been designed one of the things which is tested before construction is the system's efficiency. Explain what this involves and how it is calculated.

Among the critical steps in designing a sprinkler system is to ensure efficiency. Identify the steps important in efficiency and describe these. What needs to be satisfied to ensure that each of the steps performs successfully.

Q4. Drip irrigation is the most recently developed. What are its advantages over the traditional methods.

A Drip irrigation system has many components from the water source to the plant. Describe the components in the system.

Name the type emitters explaining how each type works.

Name also the control head and box listing what is in it and what these components do.

Q5. In gravity or surface irrigation methods are farrow and border strip methods. Describe these two methods.

Explain how furrow length and border strip lengths are determined.

How good are the two methods?

END

UNIVERSITY OF ZAMBIA
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DEPARTMENT OF SOIL SCIENCE

EXAMINATIONS FOR 2013/2014 SECOND HALF ACADEMIC YEAR

COURSE CODE: AGS 562

IRRIGATION MANAGEMENT AND SCHEDULING

==========

INSTRUCTIONS:

ANSWER: ALL QUESTIONS

TIME: 3 HOURS

MARKS: TEN (10) MARKS PER QUESTION

Q1. Among the definitions and concepts which need to be understood in order manage soil salinity in irrigation are the following:-

- SAR, Sodium Adsorption Ratio
- ESP, Exchangeable Sodium Percent
- Soil Salinity and
- Soil alkalinity.

Define and explain what each of the above mean or are. Give the equation that describes each of the above. Where possible explain and give the equation which relates the above to each other.

Q2. When designing drainage systems it is necessary to determine how much water the system should remove. Give and describe the three methods which are used to determine how much water the system should remove. Give and describe the three methods which are used to determine this amount. How is the figure finally used, determined.

Q3. The first step when preparing an irrigation plan or schedule is the listing network data. List the items needed as part of this data.

Explain the four (04) steps undertaken in the "Relative Reduction Policy" when used in irrigation management.

Q4. What are the factors which are taken into consideration when making the decision as to whether a crop has a high potential for successful irrigation. Explain each factor's importance.

Wheat is a successful irrigated crop in Zambia. Describe the methods suitable for irrigating this crop and why the other methods are not.

Q5. Explain the importance of economic analysis in the process of deciding whether a crop should be irrigated or not. Name the three (03) steps which are undertaken in economic analysis explaining the objective of each of the steps and how the final conclusion is arrived at.

The internal rate of return is also used in economic analysis. Explain what internal rate of return is and how it is used in the evaluation of the irrigation systems profitability.

Q6. When describing Land Grading there ~~are~~ are five principles which are used as guidance. List the five explaining what is involved in each step.

There are a number of compounds in agriculture which can pollute ground water and pose a danger to human beings. Identify the compounds and explain how the pollution can occur.

END

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF SOIL SCIENCE

UNIVERSITY EXAMINATIONS: JULY/AUGUST 2014

COURSE CODE: AGS 5612

LAND EVALUATION AND IMPROVEMENT

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INSTRUCTIONS:

ANSWER: ALL QUESTIONS

TIME: 3 HOURS

TOTAL MARKS: 100

Q1. A commercial farm in Mkushi has been under crop production with high inputs and mechanization for the past 35 years. The yields have since declined to about half of what they were in the first 10 years of production.

a) What are the most likely causes of this decline in yields? **(6 marks)**

b) What management practices should the farm owner have adopted at the beginning of the project to avoid the problems mentioned in (a) above? **(6 marks)**

c) As a newly graduated agriculturist, you have been appointed farm manager for farm mentioned above. What measures would you propose to alleviate the constraints? **(6 marks)**

Q2. Explain the following concepts in land evaluation and improvement **(12 marks)**

a) Management land qualities

b) Conservation land qualities

c) Ecological land qualities

d) Improvement land qualities

Q3. The USDA Land Capability Classification is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants.

a) Briefly describe the arable and non arable soil classes in the USDA Land capability Classification system **(8 marks)**

b) What is the main limitation of the USDA Lana Capability Classification? (2 marks)

Q4. A land quality is defined as a complex attribute of land inferred from a set of land characteristics. Different methods are used to combine land qualities into overall land suitability.

a) Suggest five (5) land characteristics for each of the land qualities listed below: **(15 marks)**

(i) Moisture availability

(ii) Nutrient availability

(iii) Suitability for mechanized operations

b) With suitable examples, compare and contrast between land suitability class and land suitability order **(5 marks)**

Q5. You are evaluating the suitability of a land unit for maize, sorghum, cotton and Irish potatoes using the Storie Index. The table below contains single factor indices and relevant information about the crops involved.

Factors	%	Crop	Fertilizer Requirements /ha (50 kg bag)	Potential Yield/ha (in tons)	Producer Price 50kg /bag
Management factors	100	Maize	8	10	65
Soil acidity	95	Sorghum	6	5	77.4
Soil fertility	25	Cotton	6	2	85
Soil micromorphology	50	Irish Potato	8	3.5	200
Soil erosion	100				
Slope	85				

You are further informed that the price of fertilizer is K190 per bag and that the intention is to grow 10 ha of each of the above crops. Recommend which one of the above crops is most suitable assuming that your decision is based entirely on economical returns. **(10marks)**

Q6. An investor is proposing to start a multi-million Kwacha plantation and reforestation project in one of the districts in Central Province. Discuss the most likely consequences of this development **(15 marks)**

Q7. The Land Evaluation and Site Assessment (LESA) is a point-based approach used for rating the value of agricultural land resources. Using the information provided in the table below and in Annex 1 and 2, answers the questions that follow:

Factor	Factor rating (0- 100 points)
Protected resource lands	61
Surrounding agricultural lands	38
Water resource availability	71
Project size	32
Land capability class	41
Storie Index	55

a) What is the weighted factor rating for each factor in the LESA model? **(6 marks)**

b) Determine the total LESA score for the project area **(5 marks)**

c) What is the scoring decision for the project? **(2 marks)**

d) What is the main weakness of LESA as a model for rating agricultural land resources? **(2 marks)**

END OF EXAM

Annex 1

Numeric conversion of Land Capability Classification (LCC) unit

Land Capability Classification	LCC Point Rating
I	100
IIe	90
IIsw	80
IIIe	70
IIIsw	60
IVe	50
IVsw	40
V	30
VI	20
VII	10
VIII	0

Annex 2

LESA Model Scoring Thresholds

Total LESA Score	Scoring Decision
0-39	Not considered significant
40-59	Considered significant **only** if LE AND SA sub-scores are each **greater** than or equal to 20 points
60-79	Considered significant **unless** either LE **or** SA sub-score is less than 20 points
80-100	Considered significant