

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

FIRST SEMESTER EXAMINATIONS

2012-2013 ACADEMIC YEAR

1. AGA 211 - Anatomy of domestic animals
2. AGA 331 - Animal production for engineers and FST
3. AGA 441 - Introduction to aquaculture
4. AGA 511 - Techniques in animal science
5. AGA 521 - Applied animal reproduction
6. AGA 531 - Topics in animal nutrition
7. AGA 2011 - Anatomy of Domestic Animals
8. AGA 2011 - Laboratory examination
9. AGA 3331 - Fundamentals of Animal production
10. AGA 6601 - Biochemical techniques and instrumentation
11. AGA 6601 - Biochemical techniques and instrumentation practical
12. AGA 6102 - Ruminants nutrition and metabolism
13. AGA 6012 - Endocrinology and metabolism
14. AGA 6132 - Vitamins and mineral metabolism
15. AGC 211 - Principles of crop production
16. AGC 411 - Field crop production
17. AGC 431 - Entomology
18. AGC 511 - Aspects of crop production
19. AGC 521 - Plant breeding II
20. AGC 531 - Principles of weed management
21. AGC 2011 - Fundamentals of crop production
22. AGC 3031 - Field crop production
23. AGC 6112 - Advanced plant physiology
24. AGC 6172 - Plant propagation
25. AGC 6451 - Plant breeding methods
26. AGC 6512 - Integrated pest management
27. AGC 6531 - Fungi and bacteria in plant disease
28. AGC 6611 - Plant breeding and seed systems
29. AGE 311 - Rural sociology
30. AGE 421 - Production economics
31. AGE 431 - Linear programming applications in agribusiness
32. AGE 511 - Agricultural organization and administration

33. AGE 521 - Introduction to farm management
34. AGE 531 - International Agricultural markets, trade and development
35. AGE 541 - Agricultural project planning and appraisal
36. AGE 6131 - Project planning and management
37. AGE 6211 - Agricultural policy analysis
38. AGE 6311 - Agribusiness management
39. AGF 211 - Food science and technology general microbiology
40. AGF 221 - Introduction to computer science
41. AGF 311 - Chemical techniques in food analysis
42. AGF 311 - Chemical techniques in food analysis (practical)
43. AGF 321 - Food chemistry (theory)
44. AGF 321 - Food chemistry (practical)
45. AGF 341 - Technical thermodynamics
46. AGF 411 - Unit operations in food engineering I
47. AGF 421 - Food technology I (practical)
48. AGF 431 - Fundamentals of Biochemical engineering
49. AGF 441 - Water and food waste treatment
50. AGF 511 - Unit operations in food engineering II
51. AGF 521 - Principles of food technology II
52. AGF 531 - Technology of plant products I
53. AGF 541 - Technology of dairy and egg products
54. AGF 2011 - Fundamentals of organic chemistry
55. AGF 2401 - General microbiology
56. AGF 3021 - Chemical techniques in food analysis
57. AGF 3021 - Chemical techniques in food analysis practical examination
58. AGG 311 - Experimental designs and statistics
59. AGG 3911 - Rural sociology
60. AGG 6121 - Agro climatology and crop physiology
61. AGG 6132 - Soil plant water relations
62. AGG 6211 - Biostatistics
63. AGS 211 - Fundamentals of soil science
64. AGS 311 - Agro climatology
65. AGS 411 - Soil fertility
66. AGS 431 - Soil mineralogy and micromorphology
67. AGS 441 - Agricultural hydraulics and hydrology
68. AGS 511 - Soil chemistry
69. AGS 531 - Land education and improvement
70. AGS 551 - Planning and development of irrigation and drainage systems
71. AGS 2011 - Fundamentals of soil science
72. AGS 3701 - Agro climatology

- 73. AGS 6141 - Plant nutrition
- 74. AGS 6411 - Applied soil chemistry
- 75. AGS 6431 - Soil microbiology
- 76. AGS 6432 - Soil Amendments and fertilizer technology
- 77. AGS 6442 - Soil mineralogy
- 78. AGS 6521 - Applied soil physics
- 79. AGS 6532 - Soil conservation
- 80. AGS 6542 - Soil and water conservation
- 81. AGS 6611 - Soil classification and land evaluation
- 82. AN 211 - Human Anatomy I
- 83. PGY 211 - Medical physiology
- 84. PHL 5051 - Theoretical approaches to environmental ethics

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2012 ACADEMIC YEAR: FIRST SEMESTER
FINAL EXAMINATIONS

AGA 441: INTRODUCTION TO AQUACULTURE .
THEORY PAPER

TIME: THREE HOURS

INSTRUCTIONS: ANSWER FIVE QUESTIONS. ANSWER QUESTIONS ONE, TWO AND THREE AND ANY TWO OTHER QUESTIONS. USE ILLUSTRATIONS WHERE NECESSARY

1. Discuss the following as commonly applied or understood in fish and freshwater biology:
 - (a) Dorsal formula.
 - (b) Asymptotic length (L_{∞}).
 - (c) Anadromous fish
 - (d) Pond mean depth.
 - (e) Shore line development.
2.
 - (a) Summarise the factors that determine growth rates in fish.
 - (b) Discuss the common methods that are commonly used in determining fish growth rate highlighting advantages and limitations of each one.
 - (c) Briefly summarise a parameter that could be used to determine if fish is growing in stressful or suitable environment.
3.
 - (a) Summarise the key characteristics of the family Cichlidae.
 - (b) Describe the two lineages of the family Cichlidae.
 - (c) Name the lineage of the family Cichlidae best suited for small scale aquaculture and describe characteristics of the group that make it suitable for small scale fish culture.
4.
 - (a) Describe the main characteristics of the family Clariidae.
 - (b) Name three Clariid species and indicate how they could be identified.
 - (c) Assess the potential for using Clariids for fish farming in Zambia.
5.
 - (a) Summarise the procedure that is used in giving scientific names to fish species.
 - (b) Give reasons for changing names of fish species in some situations.

TURN OVER

6. (a) Summarise main characteristics of the family Cyprinidae
(b) Name three Cyprinid species and briefly indicate how they could be identified.
(c) Assess the potential for farming Cyprinid species in Zambia.
7. (a) Describe the common method for measuring water turbidity in ponds.
(b) Summarise the significance of water turbidity in fish ponds.
8. (a) Describe the vertical depth profiles of dissolved oxygen concentrations in a mesotrophic pond under summer thermal stratification.
(b) Describe the vertical depth profile of water conductivity in the same mesotrophic pond under summer thermal stratification.

END OF THE EXAMINATION



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

FIRST SEMESTER FINAL EXAMINATIONS

COURSE : AGA 511 TECHNIQUES IN ANIMAL SCIENCE
DATE : WEDNESDAY, 27TH FEBRUARY 2013 14:00 HOURS
DURATION : 3 HOURS
INSTRUCTIONS : ANSWER ANY FIVE (5) QUESTIONS IN SEPARATE ANSWER BOOKLETS

Section I: Project Planning Cycle and Effective Proposal Writing
Question 1 (20 marks).

- i) Tabulate the steps in research proposal writing (7 marks);
- ii) What is the role of literature review in the research proposal? (7 marks); and
- iii) Explain briefly the term “metadata” (6 marks).

Section II: Research Experimental Designs

Question 2 (20 marks).

Write short notes on the following

- i) What should a researcher consider in an effort to control error in a planned experiment (10 marks)
- ii) Give the Linear Additive model for the Completely Randomized Design and the Latin square design (10 Marks)

Section III Enterprise Development, Feeding Standards and Regulations, Sampling.

Question 3 (20 marks).

- a) As manager of a feed manufacturing company you receive reports that bags of broiler feed with your company label have been found to contain mouldy feed. There are also reports that broilers that are being reared on your feed are exhibiting slow growth

rates. To follow-up on these reports you decide to have samples collected from your storage facility to verify whether the reports are genuine.

- i. What sampling plan will you utilize to ensure proof of the presence or absence of moldy feed and verify nutrient content of the feed? Give reasons for selecting the particular sampling plan or plans'
 - ii. Explain, giving reasons, how you are going to store the sample to avoid changes which may affect results of analysis
 - iii. 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?
- b) Define 'feeding standards' and write on the considerations made in applying feeding standards for growth.
- c) Imagine that you have been given a contract to develop a 200 Sow Pig Enterprise by a Non-Governmental organization with the aim of producing porkers in order to raise School fees for orphans.
- i. what stages do you expect to take the enterprise through toward its establishment?
 - ii. Summarize the activities that are expected to take place at each stage'

Section IV: Techniques in Animal Research

Question 4 (20 marks).

- a). Explain the importance of in vitro techniques for estimating digestibility of animal feeds (8 marks)?
- b). What are the advantages and disadvantages of using the nylon bag technique for evaluating the quality of feeds for ruminant animals? (12 marks).

Question 5 (20 Marks).

Mr. Mulyatubotu, an emergent beef producer in Monze District of the Southern Province, is used to monitoring the performance of his beef cattle by measuring changes in live-weight with the use weigh scales and the weigh-band

- i. Discuss with Mr. Mulyatubotu the disadvantages of the use of weigh scales and the weigh-band;
- ii. Discuss with Mr. Mulyatubotu the advantages of Body condition scoring (BCS) beef cattle;
- iii. Mention to Mr. Mulyatubotu the most important stages to body-condition his beef cattle and what are the target scores; and

- iv. If Mr. Mulyatubotu also decides to keep dairy cattle, what would be the most important stages to body condition dairy cattle and give reasons?

Question 6 (20 Marks).

Blood is harvested from livestock in for both research and commercial purposes. Whole blood, serum, specific antiserum, “aseptic blood” and a variety of blood products have a variety of uses.

- i. Describe the various methods that can used to collect blood from live animals on the farm;
- ii. Discuss the various components of blood and their functions; and
- iii. What is the importance of carrying out blood tests as a diagnostic tool in farm animals?

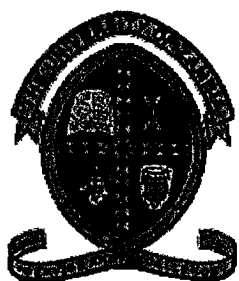
Section V: Animal Draft Power

Question 7 (20 Marks).

Although donkeys are not common in most parts of Zambia, they are gaining popularity and the demand is increasing among the farmers in different parts of the country.

- i. Explain as to why the use of donkeys for animal draft power should be encouraged in Zambia. (12 marks); and
- ii. What are some of the challenges of using donkeys for animal draft power in Zambia and what would be your recommendation? (8 marks).

The end of Examination



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

FIRST SEMESTER FINAL EXAMINATIONS

COURSE : AGA 521 APPLIED ANIMAL REPRODUCTION
DATE : MONDAY 11TH MARCH 2013 9:00 HOURS
DURATION : 3 HOURS
INSTRUCTIONS : SECTION A. ANSWER QUESTION ONE and EITHER QUESTION TWO or THREE. [TOTAL MARKS = 55]
:SECTION B. ANSWER ALL QUESTIONS
:ANSWER SECTION A AND B IN SEPARATE BOOKLETS

SECTION A

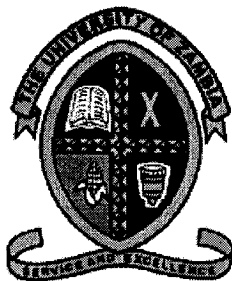
- (1) With regard to farm animals;
- a. You have been provided with three products, namely lutalyse (or estrumate), cystorelin and regumate for use on your farm animals. Provide a scientific classification of the products and rationale for using each of these products. (10)
 - b. What animals would you use these products in? (5)
 - c. What is the purpose of reproduction? (5)
 - d. With the aid of well labelled diagrams, describe the types of uteri. (10)
- (2) With regard to animal reproduction,
- a. What does the "two cell two gonadotropin" theory relate to? (10)
 - b. What contemporary cells are involved in the male reproductive system? (2)
 - c. What two advances in animal reproduction would you say have been revolutionary in spurring improving animal production? (8)
 - d. What is and when does maternal recognition of pregnancy occur in livestock? (5)

- (3) With reference to farm animals,
- a. State the timing and three methods commonly used to detect pregnancy. (8)
 - b. If you were to improve your efficiency in diagnosing pregnancy, in which combination and why would you use the same methods mentioned above? (5)
 - c. An ovariectomy has been performed and the excised ovary presented to you. Describe the anatomical features that your eye can identify on the organ. (5)
 - d. Provide a detailed drawing of a graafian follicle. (5)
 - e. How many ovaries does a female animal have in farm animals? (2)

SECTION B

4. You have been asked to provide technical advice on the setting up an artificial insemination centre for production of boar semen. Write down the contents of a manual that should be used in the Artificial insemination centre under the following headings:
- a. Semen collection
 - b. Semen evaluation
 - c. Semen processing
 - d. Semen storage
 - e. Semen utilisation. (25 marks)
5. Discuss the causes of reproductive failure in livestock under the following headings
- a. Anatomical and inherited causes of reproductive failure,
 - b. Physiological, toxicological and psychological causes of reproductive failure,
 - c. Nutritional causes and
 - d. Reproductive failure due to infectious diseases, (20 marks).

END OF EXAMINATION



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

2012 ACADEMIC YEAR – FIRST SEMESTER FINAL EXAMINATIONS

COURSE AGA 531 – TOPICS IN ANIMAL NUTRITION

DATE: MONDAY 18TH MARCH 2013

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

- a. EACH SECTION CARRIES EQUAL MARKS (50 MARKS).
 - b. ANSWER EACH SECTION IN SEPARATE ANSWER BOOKS.
 - c. ANSWER ALL QUESTIONS.
-

SECTION I: NON-RUMINANT NUTRITION ANSWER IN SEPARATE BOOKS

Question 1: Answer four (4) of the following:

- a) Lipids are a component of an animal's diet. Briefly describe the role they play in the diet and the body of pigs and poultry.
- b) Explain the factors that control voluntary feed intake in pigs.
- c) In a flow chart, define the partition of food energy in pigs and briefly, in one sentence, state the use of each component.
- d) Discuss the factors that influence the efficiency of Net Energy (NE) utilization in the pig.
- e) Contrast the energy requirements of the sow towards the end of pregnancy and that of the peak lactating sow

(16 marks)

Question 2: Answer the following:

You are being consulted by a pig farmer who has a pen of 50 growing pigs each weighing an average of 20kg. He wants to know how much feed he must have in order to finish them off in 30 days to porker weight for sale.

- a) Calculate the digestible energy requirement per day for each 20kg growing pig.
- b) How many kilo grams (kg) feed would he require to feed 50 pigs for thirty (30) days to porker weight?
- c) What are the factors that affect daily Digestible Energy (DE) intake in the growing pigs?

Assume the following: Feed Energy Constant = 455.5, Fecal Energy Constant = 9.46; and $R^2 = 0.92$; Feed contains 2,800kcal/kg

(18 marks)

Question 3: Answer all parts of the following:

You have decided to be self employed with your B.Sc. degree qualification as your lecturer insisted. Using your expert nutrition knowledge you offer to team up with your elder sister to correct the problems she is having on her small holding producing eggs and finishing porkers.

On taking a tour of the premises, you notice that she has adequate and correct quality and stocks of feed for her animals but, (i) the layers are at 50% egg production, (ii) pigs look thin, (iii) water taps are dry, and (iv) cracks in the walls of the building and (v) some roof sheets are missing!

- a) What are the consequences of the observations you made and explain why she is not realizing good profits and feed efficiency for the layers and the porkers?
- b) What remedial program must she carryout in order for her porker and egg production business to become profitable?
- c) Define the different pig production systems and highlight to her their major advantage and disadvantage.
- d) Define an (i) Energy System and Energy model, and (ii) explain why it is important to understand energy systems and energy models; (iii) **What** is and (iv) **why** is Energy interface important?

(16 points)

SECTION B: RUMINANT NUTRITION: ANSWER IN SEPARATE BOOKS

Question 4

With the help of the Pearson Square formulate a ration for beef cattle in a feedlot. The ration must contain 13.5% DCP and 75% TDN which must include 15% mixture of Natural Grass/Stylo Hay, 8% Maize Bran, 2% Sugarcane Molasses, 10% Soyabean Straw, 2% slack space for mineral supplement and 1% slack space for salt (NaCl) on dry matter basis. The table below may be used to answer the question:

Feed analyses (on dry matter basis, i.e. moisture free) are:

FEED	DM%	DCP%	TDN%	Ca	P
Natural grass/Stylo	92	22.5	58	1.90	0.20
Maize bran	90	12.5	70	0.07	1.62
Molasses	75	-	85	1.19	0.11
Soyabean straw	85	25.0	65	0.69	0.06

Other feedstuffs available are:

Maize meal	89	10.0	88	0.03	0.31
Groundnut meal	95	55.0	90	0.18	3.62
Groundnut haulms	87	12.0	62	0.07	0.17
Lucerne hay	90	85.0	60	0.27	0.03

(20 Marks)

Question 5:

- a. How much concentrate mixture consisting of 60% Maize Meal, 20% Cottonseed Cake, 10% Cassava Meal and 10% Cane Molasses should be fed to provide sufficient energy to maintain a 480 kg empty Jersey cow that is losing 0.5 kg body weight per day two weeks post-partum consuming 20 kg/day Maize Silage that produces 25 kg/day milk containing 4.5% butterfat (BF) and 8.8% solids-not-fat (SNF) per kg?
- b. What is the anticipated milk yield of the cow above at peak milk production?
- c. If the Jersey cow in 1 a. above was actually in late lactation and was gaining 0.25 kg per day. How much concentrate mixture should she be fed?
- d. If the Jersey cow in 1 a. above was actually in mid-lactation and there was no live-weight change in her body weight. How much concentrate mixture should she be fed?
- e. Using the Rapid Formulation Method calculate the forage and concentrate dry matter intake of the Jersey cow in 1 a) above?

The following may be used to answer the question:

	DM (g/kg)	ME (MJ/kg DM)
Star grass	300	9.0
Maize Meal	870	12.0
Cane Molasses	770	14.5
Cottonseed cake	920	12.5
Cassava meal	870	11.5

Dry matter (DM)
Metabolizable Energy (ME)
Mega Joule (MJ)

(20 Marks)

Question 6: Write brief notes on the following:

- a. Discuss the methods of increasing the digestibility of forages;
- b. Discuss the methods of estimating the digestibility of forages in the laboratory; and
- c. Discuss how the different classes of feeds affect the types of micro-organisms and the pH of the rumen.

(10 Marks)



The University of Zambia
School of Agricultural Sciences
Department of Animal Science

Second Year Examinations for the Degree of Bachelor of Agricultural Sciences
AGA 2011: Anatomy of Domestic Animals
First Semester, 2013

Date: March 5, 2013

Time: 14:00 – 17:00hrs

Instruction to Candidates

Answer any three questions from Section A, question 5 from Section B and either question 6 or question 7. All questions carry equal marks.

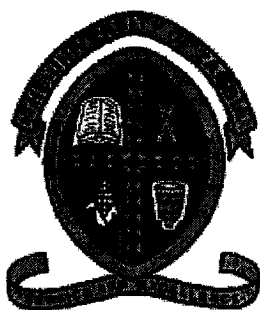
SECTION A

1. The respiratory system refers to those organs involved in the exchange of gases between the blood and the external environment. List down five organs involved in respiration and write short notes on any three of the listed organs with regards to their anatomy.
(20 marks)
2. Simple epithelium can be subdivided according to the shape and function of its cells. Describe in detail the subdivisions of the simple epithelium and give examples of the animal body in which they are found.
(20 marks)
3. The pancreas is said to be both an endocrine and exocrine gland. Explain what the terms endocrine and exocrine means, give the correct location of the pancreas in the body and briefly describe the three main sections of the organ.
(20 marks)
4. The bones of the animal body come in a variety of sizes and shapes. Write short notes on the four principal types of the bones;
 - a) Long,
 - b) Short,
 - c) Flat and
 - d) Irregular.
(20 marks)

SECTION B

5. Define and briefly describe the following terms.
- a) Foramen Ovale
 - b) Neuroglia
 - c) Glomerular capsule
 - d) Oesophageal groove
 - e) Pampiniform plexus
- (20 marks)
6. With regard to the animal reproduction;
- (a) Use a well illustrated diagram to show the components of the female reproductive system.
 - (b) What are the accessory glands found in male livestock?
 - (c) Where would you find and what is the role of the retractor penile muscle?
 - (d) Draw and label a spermatozoon? State the function of two parts of this cell.
 - (e) What are the functions of the gonads found in domestic animals?
- (20 marks).
7. With regard to the digestive system;
- (a) Use a well labeled diagram to show a ruminant stomach and the sequence in which digesta traverses through it.
 - (b) What anatomical distinguishing features would you use to identify each of the parts named above?
 - (c) What are the chambers of the cloaca of the fowl?
 - (d) Name two chief and one minor salivary glands found in farm animals.
 - (e) What are the products of two secretory cells found lining the gastric pits?
- (20 marks).

The end of the Examination



THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF ANIMAL SCIENCE

AGA 2011 LABORATORY EXAMINATION

Morning 4th March 2013

COMPUTER #:

INSTRUCTIONS

DO NOT TURN THE PAPER UNTIL YOU ARE TOLD TO DO SO. ANSWER ALL QUESTIONS. YOU HAVE *THREE (3) MINUTES* TO ANSWER EACH QUESTION

TIME ALLOWED: **50 minutes**

This question paper has 7 printed pages with the total marks of 90

QUESTION 1 [3Minutes]

Refer to specimen provided under question 1

(a) Identify the following parts labeled

A:

B:

C:

D:

E:

[5 marks]

(b) List two types of microscopes that are commonly used?

1

2

[4 marks]

QUESTION 2 [3minutes]

Identify slides **D**, **E** and **F** under the Microscope and state one important feature you have used to identify the tissue. **[6 marks]**

D:

Feature:

E:

Feature:

F:

Feature:

QUESTION 3 [3minutes]

Examine the model provided for this question. **[5 marks]**

(a) Identify the regions of the vertebral column labeled A through E

A:

B:

C:

D:

E:

(b) Write the names of the first two bones in region A

[4 marks]

1

2

QUESTION 4 [3minutes]

- (a) Identify the parts labeled A and B [2 marks]

A: B:

- (b) From the labeled regions of the specimen which type of muscle needs stimulating by a nerve for it to contract? *(Tick in the box corresponding to your option)* [2 mark]

A: ☐ B: ☐ C: ☐ D: ☐

- (c) Name the muscle you have identified: [2 mark]

- (d) Name the tissue which joins the body part labeled A to the body part labeled B

..... [1 mark]

- (e) Mention one criteria for classifying muscle [2 mark]

.....

QUESTION 5 [3 minutes]

- (a) Examine the diagram provided and identify the parts labeled M, N and O. [3 marks]

M:

N:

O:

- (b) Which hormone is manufactured by the organ labeled M? [2 mark]

- (c) Write two functions of the organ labeled N [4 marks]

1.....

2.....

QUESTION 6 [3minutes]

(a) Identify parts labeled A to F. **[6 marks]**

A:	B:
C:	D:
E:	F:

(b) What is the role of the part labeled F? **[2 marks]**

.....

.....

QUESTION 7 [3minutes]

(a) Identify the parts labeled V, W, X, Y and Z. **[5 marks]**

V:	W:
X:	Y:
Z:	

(b) Name 3 domestic animal species with these kinds of organs **[3 marks]**

1

2

3

QUESTION 8 [3minutes]

Identify parts labeled P to U **[6 marks]**

P:	Q:
R:	S:
T:	U:

QUESTION 9 [3minutes]

- (a) Write down the organs that are referred to as **accessory** organs [2 marks]

.....
.....

- (b) Give one function of any of the organs you have listed above. [2 marks]

Organ:

Function:

.....

QUESTION 10 [3minutes]

- (a) From the specimen provided under question 10 identify parts used in the calculation of magnification [2 marks]

.....

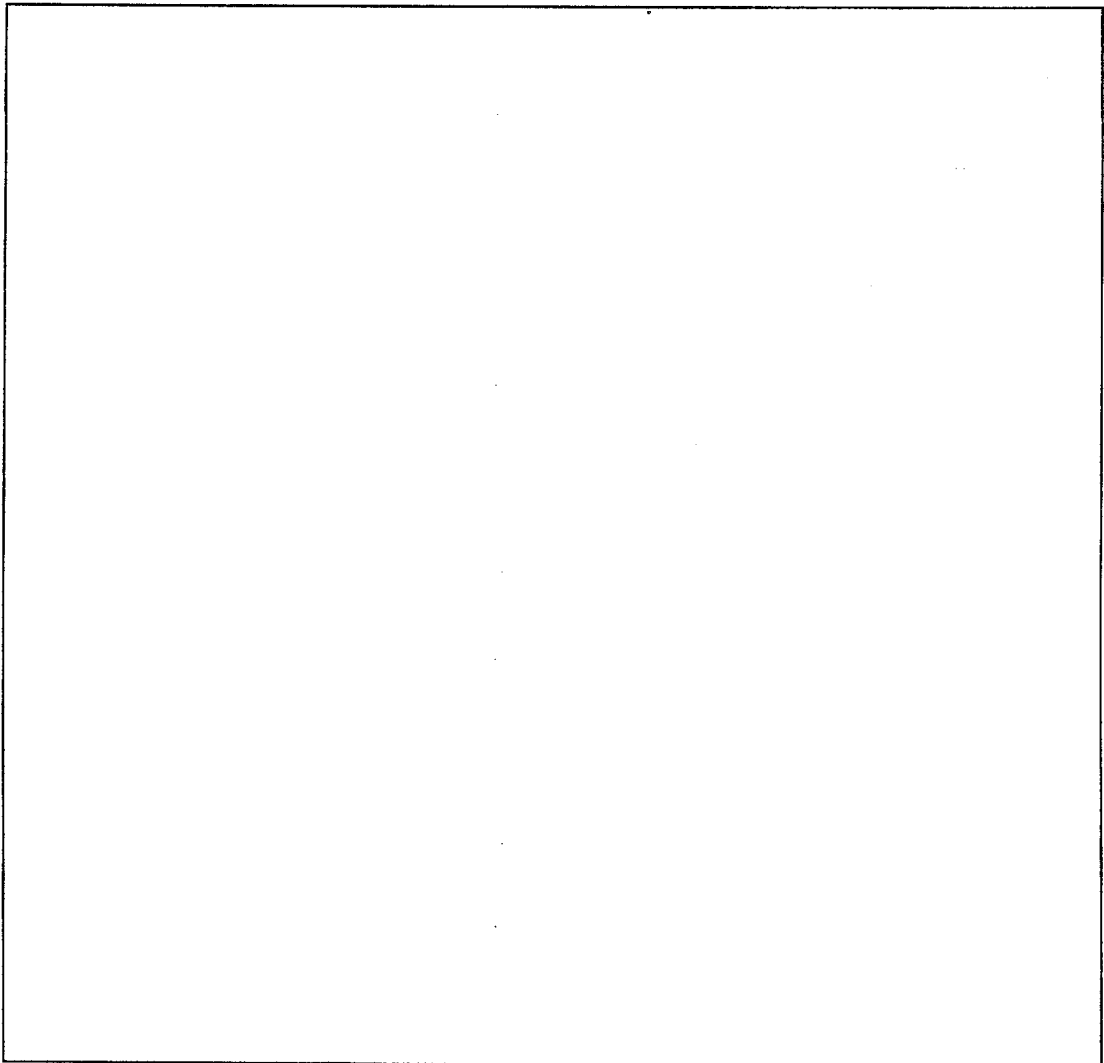
- (b) Without disturbing the microscope, look through it and **calculate** the **actual magnification** used under observation. [2, 3 marks]

Do your calculation here indicating the formula used:

QUESTION 11 [3minutes]

Draw the specimen provided in the space below and label fully.

[2, 3 marks]



QUESTION 12 [3minutes]

Specimen Y has always been recommended to cover your body while working in the laboratory..

- (a) what is the name of specimen Y**[1 mark]**
- (b) Suggest a reason for mentioned recommendation
..... **[2 mark]**

QUESTION 13 [3 Minutes]

Examine the specimen provided.

Identify parts labeled A through G

[7 marks]

A:.....

B:.....

C:.....

D:.....

E:.....

F:.....

G:.....

THE END



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2013 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATIONS**

AGA 3331 – FUNDAMENTALS OF ANIMAL PRODUCTION

DATE : 4TH MARCH 2013
TIME : THREE (3) HOURS.
INSTRUCTIONS : ANSWER QUESTIONS AS INDICATED PER SECTION.
QUESTIONS FOR THE TWO PARTS MUST BE ANSWERED IN SEPARATE BOOKLETS.

PART I

Attempt questions 1, 2 and 3

1. State the functions of the following:

a. Gizzard	f. Gastric HCl
b. Mammalian epididymis	g. Seminiferous tubules
c. Avian air sacs	h. Corpus luteum
d. Pancreatic lipase	i. Avian follicle membrane
e. Saliva	j. Scrotum

(10 marks)
2. Using some sketches or diagrams explain EITHER the gross anatomy of a horse's digestive system OR structure of an avian egg.

(10 marks)
3. Discuss the nutritional characteristics of the following materials as sources of nutrients , explaining known associated negative attributes and counter measures to maximize benefits from their usage:

a. Soybean in pig feeding	
b. Sorghum in broiler feeding	
● c. Cotton seed meal in dairy animal feeding	

(30 marks)

PART II

Answer only two questions of your choice

All questions carry equal marks

4. You are a newly appointed Extension Officer in Shangombo district and one of the residents with no knowledge of dairy farming approaches you with an idea to start a dairy as a small scale dairy farmer. From the knowledge you acquired at UNZA on the dairy farming systems which system would you recommend to this farmer? Justify your choice.

(25 marks)

5. Brooding of broiler chicks is a very critical management practice. How do you know that your brooder temperatures are right or wrong for the comfort of the chicks? What are the consequences of poor brooding on the growth of the broiler chicks?

(25 marks)

6. Good pig management assists the farmer to successfully rear and get more pigs to market weight in the shortest possible time. Briefly give an account of appropriate feeding for the pregnant sows and piglets.

(25 marks)

7. Identification is very important in beef cattle production. List down the most common methods of beef cattle identification in Zambia and describe briefly the advantages and disadvantages of any three of the methods of identification used in beef cattle production.

(25 marks)

END OF EXAMINATION



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

MASTER OF SCIENCE IN ANIMAL NUTRITION

**COURSE: FINAL EXAMINATION AGA 6601 BIOCHEMICAL
TECHNIQUES AND INSTRUMENTATION**

DATE: NOVEMBER 28TH 2011

TIME: THREE HOURS

Instructions: Read questions carefully.

Note: Choice has been given within questions.

GOOD LUCK!

Question 1 (20 Marks) Answer all parts

a) In a matrix format, for each of five (5) of the different moisture analysis methods.

- i) What is the governing principle?
- ii) When is the respective, analytical method used? and;
- iii) Give the most important advantage of each method.

(10)

b) As an analyst, you are given a sample in a container to analyze for moisture content. The inside of the container shows visible condensate. You have the following gravimetric results:

Item	Weight (g)
Dried pan & glass disc	1.0376
Pan and liquid sample	4.6274
Pan and dried sample	1.7321

- i) What procedure to obtain the moisture content? ii)
- ii) And why would you use this procedure?
- iii) What was the moisture content of the sample and
- iv) What is the percentage of solids in the sample?

(10)

Question 2 (20 Marks) Answer any four (4) of the following:

a) i) Name the three major types of ashing? ii) When is each one used? And iii) Name an important advantage and a disadvantage of each method.

(5)

b) Differentiate the three techniques for quantifying calcium with regard to the principles involved.

(5)

c) In a table format define the abbreviations ZABS, FDA, USDA, and EPA, and give two examples for each of what they do and or regulate relevant to food analysis.

(5)

d) Differentiate "standard deviation" from "coefficient of variation," "standard error of the mean," and "confidence interval."

(5)

e) Explain how solubility characteristics can be used to separate compounds in an extraction procedure and give an example.

(5)

Question 3 (20 Marks) Answer all parts

A duplicate sample of velvet bean was analyzed for fiber content by the Theander-Marlett approach. The following data was recorded:

	Sample a	Sample b
Sample weight, mg	4,503.10	4,635.70

Soluble fiber		
Monosaccharide wt, mg	280.70	291.62
Percent recovery	93.00	92.00
Insoluble fiber		
Monosaccharide wt, mg	594.80	603.94
Percent recovery	94.00	93.00
Crucible tare wt, mg	32,347.20	33,465.60
Crucible + retentate wt, mg	32,352.60	33,471.90

a) What is the (i) lignin, (ii) soluble, (iii) insoluble, and (iv) total dietary fiber content of the beans?

(8)

b) Four different values of fiber content for maize bran were reported on percent dry weight basis: 46.0, 8.9, 40.2 and 11.9 using different methods of fiber analysis.

- Indicate which method fits with each dry weight value and why?
- Justify your answer by listing the constituents measured by each method. (7)

c) Why are enzymatic methods so popular for the analysis of carbohydrates?

(5)

Question 4 (20 Marks) Answer 4a and 4b, and either 4c or 4d

a) i) Define the principles and context involved in determining the fat content of a feed product by five (5) of the following methods below:

- Soxhlet
- Babcock
- Refractive index
- Mojonnier
- Detergent
- Low resolution NMR

iii) Indicate for each method selected above, the type of sample that would be appropriate for analysis.

b) To determine the fat content of beef by refractive index method, 5 mL of bromonaphthalene was used to extract fat from 20 grams of beef. The density of fat is 0.9 g/mL, and the refractive indices of beef fat extracted solution are 1.466, 1.658, and 1.529, respectively. Calculate the fat content of the beef.

(7)

c) In a matrix; for each of the following methods to isolate solutes from feed: Headspace; Distillation and Solvent Extraction methods Define i) the principle of the technique, ii) its applications and iii) the cautions in the use of the method.

(6)

OR

- d) i) Name the three tests that can be used to help characterize a fat sample.
ii) What do the results of these tests tell you about a fat sample?
iii) Differentiate these three tests as to what chemical is being measured by each test.

(6)

Question 5 (20 Marks) Answer 5a and 5b and either 5c or 5d

- a) i) What types of stationary phases are commonly used for HPLC analysis of carbohydrate? ii) Briefly describe the principle of each to achieve separation.

(7)

- b) i) Differentiate the solubility characteristics of pectic substances, hemicelluloses, and cellulose and explain how these characteristics can be used to help quantitate these structural polysaccharides.

(7)

- c) What is the advantage of bonded supports over coated supports for partition chromatography

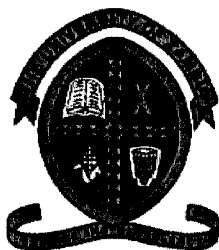
(6)

OR

- d) i) What are the compounds generated in many enzymatic methods to quantitate the carbohydrate of interest?
ii) How are these generated and quantitated?
iii) Why are they used to quantitate carbohydrates?

(6)

END OF EXAMINATION



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

MASTER OF SCIENCE IN ANIMAL NUTRITION

**COURSE: AGA 6601; BIOCHEMICAL TECHNIQUES AND
INSTRUMENTATION**

1st SEMESTER FINAL PRACTICAL EXAMINATION

DATE: MONDAY 5TH DECEMBER 2011

TIME: THREE HOURS, 09:00-12:00 HOURS

Question 1: Answer all Parts (25 marks).

A commercial farmer has experienced infertility and abortions at his dairy farm. The veterinary department has ruled out the possibility of micro organisms to have caused the deaths. Some calves have died of blindness, skin looks roughened and scaly. Before dying the animals exhibited low ability to see in the night. The farmer decides to bring samples of the feed to your laboratory.

- What would you suspect and why? (10 marks)
- Explain to the farmer, why you would want to collect your own sample for analysis? (5 marks)
- How would you collect a sample for the analysis?(10 marks)

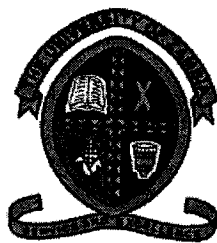
Question 2: Following Question 1a (25 marks)

- Propose one (1) simple analytical method that could be used to carry out this determination (5 marks).
- In using this Method, list the required reagents and equipment (15 marks)
- Are there any reasons you may prefer some required listed item over another (unlisted)? (5 marks)

Question 3: Using the method in Question 2a above, Determine (50marks):

- The suspected compound (40 marks)
- Explain the importance and shortfalls of this test method (10 marks).

END PRACTICAL EXAMINATION



UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

AGA 6102: Ruminants Nutrition and Metabolism End of Semester Examination

Instructions: Answer two questions from each Section. **Time:** Three (3) Hours. (24th May 2012)

Section One

1. Explain the importance of maintaining an ideal rumen environment in the fermentation process of feed materials in ruminants? What are some of the metabolic disorders that may be associated with disturbances in the normal rumen environment?
2. There are different types of microbial populations in the rumen with each one playing different roles in the fermentation process of feed materials. How do these microbes interact with each other and explain the importance of these interactions? Discuss the importance of protozoa in the fermentation process as compared to that of bacteria?
3. Explain in detail how the various products of rumen microbial fermentation are mobilized and utilized by the host animal? What are some of the advantages and disadvantages of fermentation of feed materials in the rumen?

Section Two

4. A recent retiree invested his terminal benefits in a dairy herd. He grazed his animals on a star grass pasture of 20% crude protein content during their peak milk production period. However, the animals' milk production did not increase, neither did their live weights. Comment on the protein adequacy of the diet, and explain as to what is happening based on the dynamics of nitrogen utilization in the ruminant animal. What and how would you measure to elucidate what was going on in these animals?
5. Discuss the concept of protein degradability and by-pass protein in the ruminant animal. What is your comment on the adequacy of the theory of digestible crude protein as relates to ruminants, and at what points in the process of protein digestion and metabolism in the animal would you pay attention in order to be able to feed a ruminant animal with precision as is the case with non-ruminants?

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2011/2012 ACADEMIC YEAR, SECOND SEMESTER
FINAL EXAMINATIONS

AGA 6012
ENDOCRINOLOGY AND METABOLISM

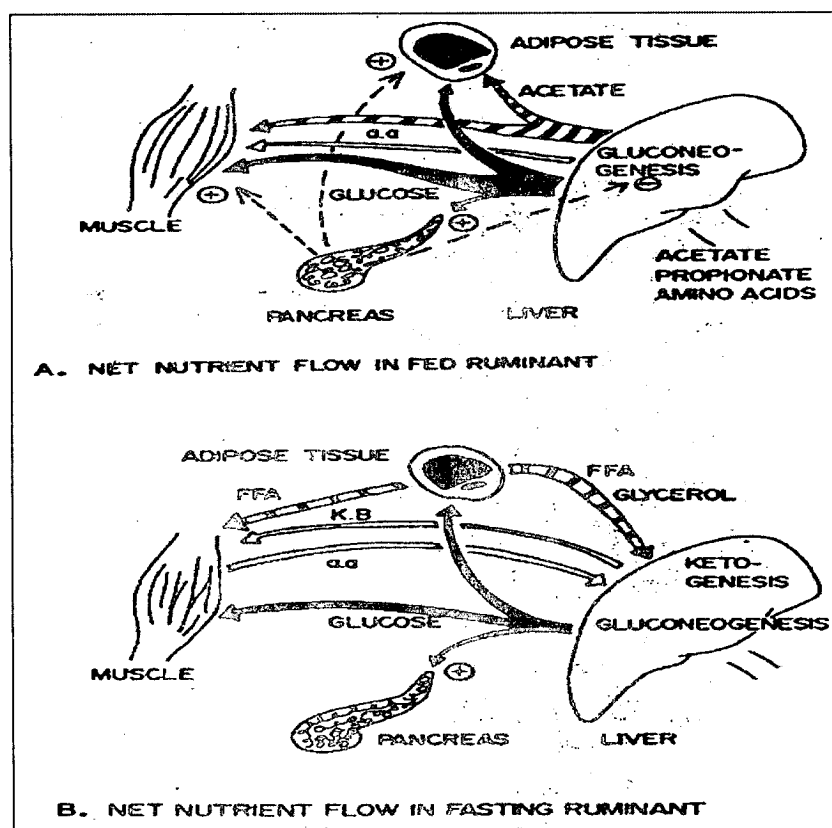
TIME ALLOWED: THREE HOURS

INSTRUCTIONS:

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

SECTION A

- Q1.** The figure below shows a summary of movement of nutrients in a fed (A) and fasting (B) ruminant animal.



- a)** Discuss the role and mode of action of growth hormone in both situations. (20 marks)
 - b)** Discuss the possible effects of thyroid hormones in the fed ruminant, indicating the mode of action. (15 marks)
- Q2.** Discuss the concept of regulation of hormone receptors. (15 marks)

SECTION B

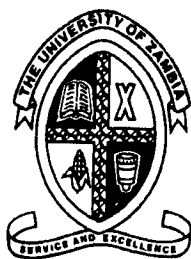
USE A NEW ANSWER BOOK AND LABEL AS SECTION B

Q3. An animal is adrenalectomized. The animal starts producing large volumes of urine with high concentration of Na^+ . Within a few hours, the animal has low blood volume and circulatory insufficiency.

- a. Identify the hormone which has been removed through adrenalectomy? (2 Marks)
- b. What are the functions of the hormone you have named? (8 marks)
- c. What is the Mode of action of the identified hormone? (10)
- d. How is the secretion of this hormone regulated? (10)

Q4. Briefly describe the following:

- a. The job description of Parathyroid Hormone and its control? (10)
- b. Mechanisms of FSH/LH control of estrous cycle? (10 marks)



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

MASTER OF SCIENCE IN NUTRITION

COURSE: AGA 6132 VITAMINS AND MINERAL METABOLISM

DATE: FINAL EXAMINATION JUNE 1ST 2012, 09:00 HOURS

Lecturers: Drinah Banda Nyirenda, PhD Senior Lecturer
Ms. Martha Musukwa, MSc., Special Research Fellow Ph.D. Candidate

Time: 3 Hours

INSTRUCTIONS:

1. Answer Part I- Vitamins and Part II- Minerals in Separate Answer Books
2. Read Questions Carefully, As Some Have Components and Choices Within Questions

PART I: VITAMIN METABOLISM

Question 1 (15)

As the consultant for poultry producers in Chongwe North, you have been informed that a new feed from the cooperative has led to a 40% drop in growth rate and a mortality rate increase of 5%. The laboratory analysis of the feed, has shown very low Cobalamine (B₁₂) and Niacin, respectively.

- (a) Briefly discuss with your farmers:
- The metabolic importance of the two vitamins;
 - In deficiency, explain the theoretical sequence of events leading to physical problems with each vitamin;
 - Give two examples of biochemical functions of each vitamin to support your explanation and;
 - What remedial action will you take to improve productivity?
- (b) Using the chemistry of vitamin C (Ascorbic Acid) **OR** Biotin (**CHOOSE ONLY ONE**)
- Explain the importance of the chosen vitamin in animal metabolism;
 - Give three (3) biochemical functions and;
 - What are the anti-metabolites (antagonists) of the vitamin you selected and;
 - How do the antagonists affect the metabolism of the vitamin and its function?

Question 2 (10 marks)

- (a) In a matrix, choose three (3) of the following vitamins; Vitamin A, Folic acid, Ascorbic acid, Pantothenic acid and Vitamin E.
- Give two (2) metabolic functions of each,
 - Two (2) deficiency symptoms of each and
 - one good source of each
- (b) Do any of these vitamins show any biochemical interrelationships with each other? If so which ones and illustrate how they interrelate?

Question 3 (15 marks)) Answer all parts

- (a) Pick a vitamin of your choice and;
- Give three metabolic functions and;
 - Explain the metabolic importance in the animal overall metabolism and;
 - Give two specific deficiency symptoms that correlate to the biochemical functions.
- (b) Briefly, provide a scientific analysis differentiating the water soluble vitamins from the fat soluble vitamins by their:
- Biochemical functions,
 - Active sites,
 - Deficiency symptoms and;
 - Occurrence in nature.

Question 4 (10 marks) Answer all parts

- (a) Niacin is an important vitamin in food metabolism. Answer the following:
- Name the form in which niacin acts in metabolism,
 - Illustrate and name its major biochemical functions.
- (b) Demonstrate the coupled oxidation – reduction reactions that Niacin is involved in.

Question 5 (10 marks) Answer (a) and (b), OR (c)

- (a) In the blood clotting mechanism:
- At what point does vitamin K function?
 - Name three antagonists of vitamin K and
 - Illustrate how they affect the function(s) of vitamin K.
- (b) Name three (3) metabolic reactions that Pyridoxine (B₆) is involved in, in the body.
- OR**
- (c) What happens metabolically and physically when vitamin (B₆) is deficient?

PART II: MINERAL METABOLISM

Answer this section in a separate answer book

Question 6 (10 marks) Answer all parts

Sodium and Chlorine are interrelated in their functions in the animal body.

- (a) Discuss briefly on any five common deficiency signs and their interrelationships in these minerals.
- (b) Relate two of these deficiency symptoms to the biochemical functions of the minerals

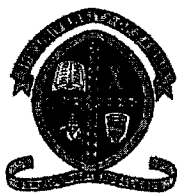
Question 7 (10 marks) Answer all parts

- (a) Briefly explain one of the roles of the tri-peptide glutathione in metabolism.
- (b) Name two minerals that are involved in the antioxidant function.
- (c) What is the respective role of each mineral in the oxidation/reduction reactions involved in this antioxidant function?

Question 8 (20 marks) Answer all parts

- (a) What are the interrelationships between Iron, copper and sulphur in oxygen metabolism in the animal body?
- (b) What happens when copper is lowest and why?
- (c) In a matrix give two deficiency, two toxicity symptoms, and two dietary sources of each of the minerals in (a) above.

END OF EXAMINATION



UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF PLANT SCIENCE
Fourth Year Examinations for Bachelor of Agricultural Sciences
AGC 3031/411 FIELD CROP PRODUCTION
First Semester 2012/13

Date: 11th March, 2013

Time: 14:00 – 17:00 hrs

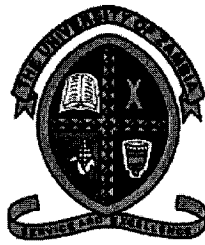
Instructions: Answer all Questions.

Marks are as Indicated.

-
1. The following questions relate to Maize (*Zea mays*) production:
- a. What are the soil and climatic requirements for Maize production? (5 marks)
 - b. When selecting varieties, which series is recommended for planting in Agroecological Region II of Zambia? (1 mark)
 - c. When is Maize physiologically mature? What is the moisture content when Maize is physiologically mature? (2 marks)
2. Answer the following questions:
- a. What is the International Centre for Sorghum and Millet research called? In which country and continent is the Centre located? (3 marks)
 - b. What is the economic importance of Finger millet (*Eleusine coracana*)? Give relevant examples. (6 marks)
 - c. Why are Millets and Cassava considered important famine foods in Africa? (4 marks)
 - d. In Sweet Potato (*Ipomoea batatas*) production, how many vines are planted per station? How are the vines planted? (2 marks)
3. The following relate to Wheat (*Triticum spp*) production.
- a. What are the recommended dates for planting Wheat in Zambia? (7 marks)
 - b. A small scale farmer in Kasama would like to grow Wheat for the first time. Advise on the variety to be grown. Give a reason for your choice. (2 marks)
 - c. Name a pest the farmer is likely to face/have in her production. Discuss how she can save her crop from pest damage giving relevant examples. (7 marks)
4. A farmer in Gwembe district is planning to grow Cotton (*Gossypium spp*). As an Agronomist, advise on the following:
- a. When is the crop planted? (1 mark)
 - b. How is cotton planted? (5 marks)
 - c. When is cotton ready to be harvested? (2 marks)
 - d. Describe the process of harvesting Cotton. (10 marks)
 - e. What is the legislation that governs Cotton production in Zambia? (2 marks)

5. The following relate to Soyabean (*Glycine max*) production:
- To which family does Soyabean belong? (1 mark)
 - Hernon 147, Kaleya, Santa Rosa and Magoye are varieties of Soyabean. Group these varieties (into 2 groups) according to the characteristics they possess which are common. What can be done to each grouping in order to improve their productivity? (10 marks)
6. A farmer in Mporokoso District would like to practice Conservation Agriculture (CA). As an Agronomist, answer the following questions:
- What is Conservation Agriculture (CA)? (2 marks)
 - What are the reasons/causes for a decline in soil productivity? For each cause, give the corresponding strategy that CA provides. (10 marks)
 - What practices of CA are not suitable for Agroecological Region III of Zambia? Which practices would be applicable for Agroecological Region III of the country? (6 marks)
7. A farmer would like to know about Organic Agriculture before venturing into this type of farming. As an Agricultural Officer for Chongwe District, answer the following questions that a farmer may have:
- What is Organic Agriculture (OA)? (2 marks)
 - What are the principles (list up to 4) that govern OA? (4 marks)
 - Why is a living soil important in OA? (1 mark)
 - What are the practices that are undertaken in order to add life to the soil? (7 marks)

END OF EXAM



UNIVERSITY OF ZAMBIA
School of Agricultural Sciences
Department of Plant Science

Fourth Year Examinations for Bachelor of Agricultural Sciences
AGC 431: Entomology
First Semester 2012/13

Date: 28th February, 2013

Time: 09:00-12:00h

Venue: Omnia L. T.

INSTRUCTIONS: Answer ALL questions
Marks are as indicated

Q1. Multiple Choice. Choose the BEST answer. [2 Marks each]

- i. Which sclerite lies above the epistomal suture?
A. Labrum B. Clypeus C. Frons D. Gena
- ii. Insect blood does **NOT**:
A. Flow through the wings. B. Clot C. Contain antibodies D. Transport hormones
- iii. Which insects do **NOT** feed on plants?
A. Thrips B. Lacewings C. Whiteflies D. Sawflies
- iv. Which order would a “lumper” **NOT** include in the order Orthoptera?
A. Mantodea B. Isoptera C. Phasmida D. Grylloblattodea
- v. The order Diptera does **NOT** include
A. Midges B. Sawflies C. Mosquitoes D. Gnats
- vi. Which structure could be found in **BOTH** male and female insects?
A. Aedeagus B. Valvifer C. Epiproct D. Clasper
- vii. Which structure is **NOT** part of the female reproductive system?
A. Follicle B. Spermatheca C. Bursa Copulatrix D. Accessory gland
- viii. What is the function of the cement layer in the insect's exoskeleton?
A. It makes the exoskeleton rigid B. It prevents water loss C. It protects the wax layer from abrasion D. It acts as insulator during moulting
- ix. If you found a larva with prolegs, you would know that it could **NOT** be a :
A. Butterfly caterpillar B. Sawfly larva C. Moth caterpillar D. Fly larva
- x. Dragonflies (Odonata), Stoneflies (Plecoptera), and Mayflies (Ephemeroptera) have which of the following in common?
A. Nymphs called naiads; B. Hind wings that are held out to the side of the body; C. Sucking, mandibulate mouthparts; D. No caudal appendages.

Q2. Short answers. [2 Marks each]

- a. The axilla is a small pleural sclerite located just above the mesepimeron in some insects. It provides a site for attachment of direct flight muscles. On which thoracic segment would you expect to find this sclerite?
- b. Which mouth parts bear palps?
- c. To which body segment are the halteres attached?
- d. In an abdominal segment, the ventral sclerite is known as.....
- e. In insects with mandibulate mouth parts, which structure lies between the mandibles and the maxillae?
- f. The sawflies belong to which order of insects?
- g. Most terrestrial arthropods exchange respiratory gases using chitin-lined tubes that open to the outside. What are the tubes called?
- h. What sort of skeleton does an insect have?
- i. The Thrips belong to which order of insects?
- j. Which structures would be found in an eruciform larva, but **NOT** in a scarabaeiform larva?

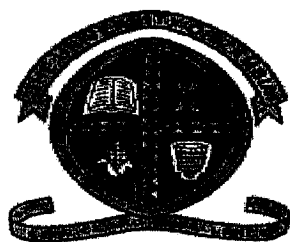
Q3. Describe: A. Where would you find the structure(s) below. B. What is its principal function? [2 Marks each]

- | | | | |
|--------------|----------------------|--------------------|----------------------|
| i. Furcula | ii. Haltere | iii. Hypopharynx | iv. Micropyle |
| v. Hamuli | vi. Spermatheca | vii. Fossorial leg | viii. Corpora allata |
| ix. Spiracle | x. Malpighian tubule | | |

- Q4.**
- a) How does the structure of the endocuticle differ from that of the exocuticle? **[5 Marks]**
 - b) How do the wings of the insect order Coleoptera differ from those of the order Orthoptera? **[5 Marks]**
 - c) How do the orthopteroids differ from the hemipteroids? **[5 Marks]**
 - d) How does the heterodynamic life cycle differ from the homodynamic life cycle? **[5 Marks]**

- Q5.** Identification of insects is one of the necessary skills that an entomologist should acquire.
- i. Discuss the complications associated with insect identification.
 - ii. Outline six (6) ways in which one may identify an unknown insect. **[20 Marks]**

xx**END OF EXAM**xx



**UNIVERSITY 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.

Q.1 (a) Plant breeding involves selection as the main mode of developing superior materials. What is selection? (3 points). Give a clear elaboration on how you would improve selection for a trait of interest, pointing to the challenges that may be encountered? (12 points).

(b) Using chi-square check if the given population is in equilibrium.

	WW	Ww	ww
Number of individuals	600	180	60

(25 points)

SECTION B: Answer at least ONE question

Q. 2: (a) Discuss the categories of plant tissue culture techniques utilised in plant biotechnology (16 points)

(b) What are the roles of deoxyribonucleoside triphosphates (dNTPs) and Taq polymerase enzyme in a Polymerase Chain Reaction (4 points)

Q. 3 (a) A seed company which has little knowledge on molecular marker assisted selection have approached you for advice, as an expert in plant breeding and biotechnology. They need your assistance to help them select an appropriate marker technique to utilise in marker assisted selection for resistance to Anthracnose in Beans. They have an option of either using Simple Sequence Repeats (SSR) or Random Amplified Polymorphic DNA (RAPD) molecular markers at their disposal. What advice can you give and clearly elaborate the reasons for your choice of marker? (12 points)

(b) Discuss the production of Aneuploids and their application in crop improvement (8 points)

SECTION C: Answer any question(s).

Q. 4 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.5 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

PRINCIPLES OF WEED MANAGEMENT AGC531
FINAL EXAMINATION
DATE: 7th MARCH 2013
VENUE: OMNIA LECTURE THEATRE
TIME ALLOWED: (3) HOURS 09:00 – 12:00hours

INSTRUCTIONS

There are two (2) sections to this examination. Section 1 is compulsory, answer it all. Section 2 is optional. Answer only two questions. Points for each question are indicated.

SECTION 1 (COMPULSORY)

Q1 (30 points)

Agricultural pests are many and varied, and weeds are one of them. In fact, weeds are the most underestimated pest of tropical agriculture and have influenced human social actions more than any other crop pests in the tropics. One can argue that the challenge of transforming developing countries from food deficiency status to food sufficiency status will require a myriad of solutions one of which is improvements in weed management. However, you can only manage what you know. Part of the goals of this course was for students to be familiar with weed flora and control methods used in managing weeds. Show that these goals were achieved by:

- Listing five (5) parasitic weeds by scientific name from five (5) different families; five (5) aquatic weeds by scientific name from five (5) different families; and ten (10) different terrestrial, autotrophic weeds from ten (10) different families.
- Classify the aquatic weeds with concrete examples of each category.
- What characteristics are peculiar to most weeds that you do not readily find in most domesticated plants?
- What is a herbicide formulation and what is its purpose?

SECTION 2 (OPTIONAL)

Answer only two questions.

Q2 (15 points)

In nature, living organisms are engaged in relentless competition with peers as well as with other organisms and plants do not escape this struggle for existence.

- a) List three biological interactions that are of major significance in weed crop interaction.
- b) Define each of them separately, pointing out how they affect the crop negatively.
- c) List three major herbicide grouping and highlight the active ingredient of each of them.

Q3 (15 points)

- a) When a herbicide comes into contact with a plant, its action is influenced by morphological and anatomical features, and numerous physiological and biochemical processes. These interactions with the herbicide determines the effects of specific herbicide on a given plant species. Enumerate these features and processes providing short notes to briefly explain each of them.
- b) List five (5) beneficial aspects of weeds with concrete examples of local weeds that have those aspects.

Q4 (15 points)

- a) Classify parasitic weeds.
- b) Enumerate how you would control the different types of parasitic weeds pointing out which ecological principles you are using.

End of Final Examination!



The University of Zambia

School of Agricultural Sciences

Department of Plant Science

Second Year Examinations for the Bachelor of Agricultural Sciences

AGC 2011: Fundamentals of Crop Production

First Semester 2012/2013

Date: 1st March, 2013

Time: 09:00 - 12:00 hrs

Venue: Omnia Lecture Theatre

INSTRUCTIONS:

1. Answer ALL questions
2. Marks as indicated

Question 1 (20 Marks)

- a) Name 2 constraints faced by farmers in the economic, social and environmental areas. Briefly describe how these constraints can be overcome? (4 Marks)
- b) Explain how improved fallows contribute to increased maize yields. (4 Marks)
- c) Briefly explain how external and endogenous (phytohormones) affect the plant development stage of senescence. (5 Marks)
- d) Given:
 - i) The atmosphere and temperature of planet Mars in A and the atmosphere of planet Earth in B:

A

Temperature

Maximum	-	-5°C
Minimum	-	-87°C
Mean	-	-46°C

Atmosphere

Surface pressure	-	0.7-0.9 Kpa
CO ₂	-	95.72%
N ₂	-	2.7%

Argon	-	1.6%
O ₂	-	0.2%
CO	-	0.07%
Water vapour	-	0.03%
NO	-	0.01%

There is water ice below the surface

B

Atmosphere

N ₂	-	79.0%
O ₂	-	20.97%
CO ₂	-	0.03%

- ii) The nutrient composition of one of the rocks is given in Figure1.

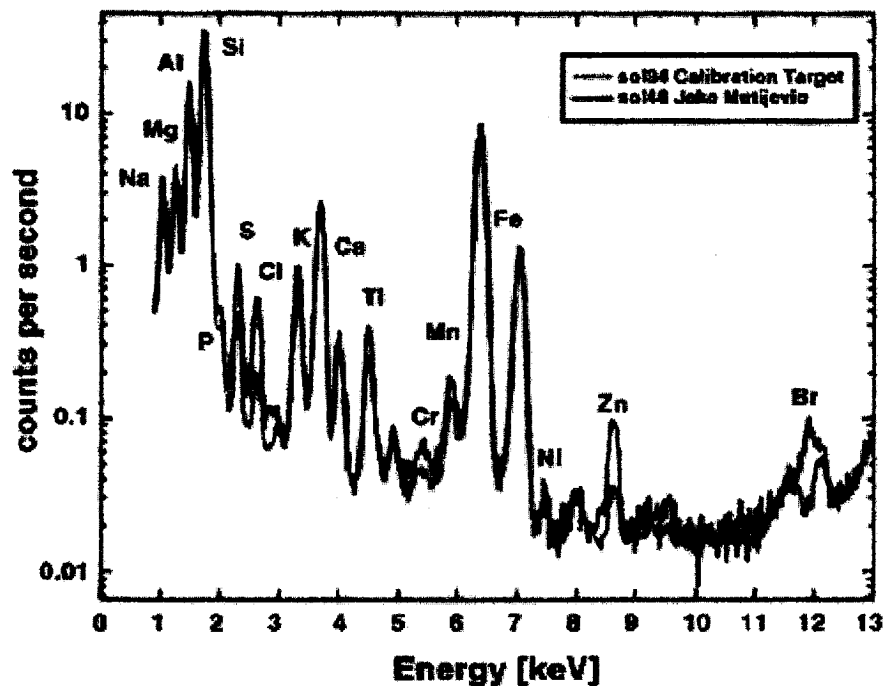


Figure 1: Mineral composition of one of the rocks on Mars

- iii) Evidence of water in Mars history, how could ancient planet Mars been habitable especially for plant life? (7 Marks)

Question 2 (20 Marks)

In September 2000, building upon a decade of major United Nations conferences and summits, world leaders came together at United Nations Headquarters in New York to adopt the United Nations Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty. They set out a series of time-bound targets - with a deadline of 2015 - that have become known as the Millennium Development Goals. With less than 2 years to reach the Millennium Development Goals,

which three of the Goals is Zambia likely to achieve with improvements in agricultural productivity and production. Give reasons for your answer.

Question 3 (20 Marks)

- i) If 2 soils with clay and sandy loam textures with the same water content are in contact with each other, which way will the water flow? **(4 Marks)**
- ii) Describe 3 methods for soil water measurement and the underlying principles of the methods. **(6 Marks)**
- iii) The rainfall over a 10-day period was 13 mm. A farmer has irrigated her crop with 9 mm water. Assuming drainage of 2 mm and negligible runoff, what was the average evapotranspiration? **(10 Marks)**

Question 4 (20 Marks)

Climate-Smart Agriculture addresses the challenges of food security, climate adaptation, and mitigation in an integrated fashion, rather than in isolation. How does Conservation Agriculture adopted by the Republic of Zambia in 1999 responsive to Climate-Smart Agriculture?

Question 5 (20 Marks)

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

- i) Describe the characteristic features of each of the families. **(6 Marks)**
- ii) Name 2 crops belonging to each of the families. **(3 Marks)**
- iii) What are the scientific names and places of origin of the above mentioned 6 crops? **(3 Marks)**
- iv) Describe at least 4 optimum conditions of growth of the above mentioned 4 crops. **(4 Marks)**
- v) Describe at least 4 uses of economic importance of the above mentioned 4 crops. **(4 Marks)**

END OF EXAM



UNIVERSITY OF ZAMBIA

School of Agricultural Sciences

DEPARTMENT OF PLANT SCIENCES

Programme: Master of Science, Agronomy ; Plant Breeding & Seed Systems

AGC 6112: ADVANCED PLANT PHYSIOLOGY

FINAL EXAMINATION

Date 2nd December 2011

Time 09:00 to 12:00 hrs

INSTRUCTIONS

1. Answer ANY FOUR (4).
 2. Duration- Three hours.
-

1. Answer the following;

- i. Explain with examples the quick and slow phytochrome responses. [15 marks]
- ii. Suggest what would happen when photoperiod sensitive plant species are grown in constant light duration environment. [10 marks]

2. Give a general framework of the effects of stress on plant development. Specifically give at least 2 examples of a plant processes that are affected by the following degrees of water stress:

- i. Low water stress (-1 to -5 bars of soil water tension);
- ii. Moderate (-5 to -10 bars of soil water tension);
- iii. High water stress (-10 to -15 bars of soil water tension). [25 marks]

3. Give a general account of use of growth regulators in agriculture?

[25 marks]

4. Answer in brief any TWO.

- a. The three sub groups of the C₄ plants;
- b. Quantum yield;
- c. Critical areas of agricultural research to deal with climate change. [25 marks]

5. Describe in detail four important physiological traits that are important in determining plant productivity. [25 marks]

END OF EXAMINATION



UNIVERSITY OF ZAMBIA

School of Agricultural Sciences

Department of Crop Science

MSc AGRONOMY PROGRAMME FIRST YEAR FINAL EXAMINATIONS

AGC 6172: PLANT PROPAGATION

Second Semester- 20011/2012

Date 1st JUNE 2012

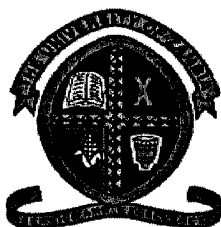
Time 14:00 to 16:30 hrs

INSTRUCTIONS

- i. Answer ANY 4 (four) questions.
- ii. Duration- 3 (three) hours.

-
1. Explain briefly the following
 - a. A rootstock screening grid;
 - b. Poly embryony and its application to propagation. **[25 marks]**
 2. What is disease indexing and describe at least 2 disease indexing methods. **[25 marks]**.
 3. Describe a general Quality Control scheme and how it applies to plant propagation. **[25 marks]**
 4. Explain the physiological and anatomical aspects of grafting. **[25 marks]**
 5. What is apical dominance and what challenges does it pose to vegetative propagation. **[25 marks]**
-

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

Examinations for Master of Science in Plant Breeding and Seed Systems

AGC 6451: PLANT BREEDING METHODS
First Semester 2011/2012 Academic Year

DATE: Thursday December 8th 2011, AM.

TIME: THREE HOURS

Answer five questions only. All Questions Carry Equal Marks

1.0 Write short notes on the following:

(20 marks)

- a) Genetic erosion
- b) Invitro mutagenesis of Vegetatively propagated crops
- c) Modified Single cross Hybrids
- d) Participatory Plant Breeding
- e) Why single cross seed is relatively less expensive compared to that of a Three way cross

2.0 List and discuss what you would consider to be the five (5) most important considerations in Plant Breeding Priority Setting (*Setting Breeding Objectives*), both technical and non-technical

(20 marks)

ANSWER EITHER QUESTION 3 OR 4 COMPULSORY QUESTIONS

3.0 Zinc deficiency has been recognized as serious health concern in Developing countries, where it causes arrested brain development in children. Zambia has decided to develop a crop improvement program aimed at developing micronutrient heavy (biofortified) cereal crops.

Indian researchers have found that the enzyme phytase activity is negatively correlated to zinc content in maize grain and that the phytase activity can be used as an indirect selection criteria for zinc in maize either as a sole measure or in combination with the actual zinc determination in the grain itself. The Phytase activity can be determined at the three leaf growth stage of the maize seedling.

Supposing you are tasked to develop maize Open Pollinated and Hybrid varieties that are high in **grain zinc** and also **high yielding**:

- a) Suggest a simple study to verify the reported strong negative correlation between the enzyme Phytase activity and grain ~~yield~~ **zinc content** (5 marks)
- b) Present a clear breeding program that you would follow to develop Open Pollinated and Hybrid varieties that are high in **grain zinc** and also **high yielding** (15 marks)

4.0 In a continuation of the Zambian Program of biofortification of important cereal crops another cereal, sorghum has been chosen for increasing the iron content of the grain. To achieve this, Plant breeders have decided to develop varieties from the popular ten (10) sorghum land races available in the country. Just as in maize the enzyme Phytase has an influence on Fe content in the grain of sorghum and the association is also negative.

- a) Clearly explain how you would develop sorghum lines with high grain Fe content and also high yielding for release as varieties (10 marks)
- b) It has been reported that Fe content has a heterotic response in hybrid combination. Clearly explain how you would develop Hybrid sorghum varieties with high Fe content and also high yielding (10 marks)

5.0 a) What do you understand by the term Response to Selection (5 marks)

b) List factors that affect the response to selection (10 marks)

c) Suppose In the first year of a maize breeding program there is a drought, so you decide to select primarily for husk cover (length of husk extension beyond the tip of the ear) that season. The mean of 250 families is 2.5 cm. You select the best families, which have a mean of 3.1 cm. After recombining the selected families, you note that the average for the improved population is now 2.8 cm. Assuming that the initial population still has a mean of 2.5 cm that year, what is the **realized heritability** for this trait? (5 marks)

6.0 a) Define inbreeding depression and hybrid vigour. (5 marks)

b) How do these phenomena affect the self, vegetatively propagated and cross pollinated crop species? Explain with the help of example (15 marks)

7.0 Can Zambia/Namibia achieve its own Green Revolution in crop production. Discuss giving **plausible** and **realistic** reasons why you think this can or cannot be achieved. (20 marks)

-----END OF EXAMINATION AND MERRY X-MAS !-----



**The University of Zambia
School of Agricultural Sciences
Department of Plant Science
Examinations for the Master of Science in Agronomy
AGC 6512: Integrated Pest Management
Second Semester 2012**

Date: 28th May, 2012

Time: 09.00 – 12.00hrs

Venue: Vet LT3

Instructions:

- 1. Answer four questions**
- 2. All questions carry equal marks**

- Q1. What is Integrated Pest Management (IPM)? Describe the steps involved in the implementation of an IPM programme.
- Q2. Application of IPM programmes relies on economic damage, economic-Injury Level and economic threshold concepts.
- a) Define the three concepts
 - b) What are the major limitations in the application of these concepts
- Q3. Pesticides are used as a last resort in IPM programmes. What are the major advantages and disadvantages of using pesticides in IPM programmes.
- Q4. What is cultural control? Describe the various cultural control tactics used in IPM programmes.
- Q5. Biological control is an important component of IPM programmes.
- a). Describe the various practices of biological control.
 - b). What are the desired characteristics of effective biological control agents?
- Q6. Cowpea is an important food legume grown by small scale farmers. Cowpea is attacked by aphids, flower beetles, pod borer weevils, pod sucking bugs, bruchid beetles, cercospora leaf spot and bacterial blight. Aphids, cercospora and bacterial blight attack the leaves. Flower beetles attack flowers and pollen. The pods are attacked by weevils, bugs and beetles. The insect pests are attacked by predators and parasites. Environmental factors such as rainfall, temperature, sunlight, soil fertility have an important impact on both the cowpea and the pests.
- a) Construct a conceptual model for the cowpea and its pests.
 - b) Define and identify state, rate and driving variables in the cowpea cropping system.

END OF EXAMINATION



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

Final Examination
AGC 6521

Second Semester 2012

Date: June, 2012

Time: 09.00 – 12.00hrs

INSTRUCTIONS

TIME: 3 HOURS

ANSWER: ALL QUESTIONS

ALL QUESTIONS CARRY EQUAL MARKS

1. It is stated that the number of arthropods species in community is closely related with five major factors. Outline and discuss these factors.
2. The length of time available for colonization among annual, medium and long-lived crops is very different. Discuss.
3. Discuss diversity in terms of the environment insects must exploit.
4. Discuss **r** and **k** strategies of insects in relation to colonization.

******* END OF EXAMS *******

**THE UNIVERSITY OF ZAMBIA
DEPARTMENT OF CROP SCIENCE**

2012 SECOND SEMESTER FINAL EXAMINATIONS

AGC 6531: FUNGI & BACTERIA IN PLANT DISEASE

THEORY PAPER

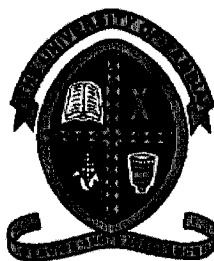
TIME: THREE HOURS

INSTRUCTIONS: ANSWER ANY FIVE QUESTIONS.

USE ILLUSTRATIONS WHERE NECESSARY

1. Define vascular-wilt diseases of plants? State fungal and bacterial pathogens of vascular wilts and describe diagnostic disease symptoms and the mechanism of wilting.
2. Discuss early blight of tomato with reference to its causal agent, disease symptoms and methods of control.
3. State wheat rusts of common occurrence in Zambia and describe spore stages that develop in Zambia. Identify the spore stage which causes maximum damage to the host plant, and explain why.
4. State bacterial diseases and their host plants of common occurrence in Zambia. Describe disease symptoms of one such disease and suggest how it can be controlled.
5. Describe the causal agent, disease symptoms and control measures of leaf spot of maize.
6. Identify causal agents and disease symptoms of damping-off diseases and explain the effect of climatic conditions that favour incidence of such diseases.
7. Describe methods of control by which plant diseases are controlled in the field.
8. Summarize any **Four** of the following:
 - (a) Whip smut of sugarcane
 - (b) Hot water control of wheat smut
 - (c) Fusarium-wilt of tomato
 - (d) Downy mildew of maize

END OF EXAMINATION



UNIVERSITY OF ZAMBIA

School of Agricultural Sciences
First Year Examination for Master of Science in Plant Breeding
and Seed Systems

AGC 6611
First Semester 2011/12

Date: 25th November 2011..... Time: 09 00 hrs

Duration: 3 hours

Total marks: 60

Instructions: Answer any six

1	<p>Seed processing is an important activity in a seed value chain. Discuss how seed deterioration may be avoided during the following practices.</p> <ul style="list-style-type: none">a) Shelling/threshing [2.5 Marks]b) Seed treating [2.5 Marks]c) Seed handling [2.5 Marks]d) Seed bagging [2.5 Marks]
2	<p>Seed of a released variety is carefully multiplied by seed growers. During the different stages of seed multiplication and seed testing, the seed is checked for conformity to set standards. Seed lots that are satisfactory are certified for sale. However, the certified seed lot may be sold over a range of time and may deteriorate in its viability while in storage before it is sold. Discuss factors that may cause seed deterioration in storage highlighting how this can be avoided.</p> <p>[10 Marks]</p>

3	<p>There are various components of the seed value chain that depend on each other for an effective functioning of a seed industry. Explain the value that each of the following components brings to the seed value chain.</p> <ul style="list-style-type: none"> a) Training of plant breeders [2 Marks] b) Plant breeding [2 Marks] c) Seed production [2 Marks] d) Seed quality control [2 Marks] e) Farmer [2 Marks]
4	<p>Write brief notes on the importance of the following in seed production</p> <ul style="list-style-type: none"> a) Seed crop registration [3 Marks] b) Seed crop isolation [2 Marks] c) Roguing [2 Marks] d) Crop inspections [3 Marks]
5	<p>What is the relevancy and procedure of conduction the following seed quality tests for seed certification.</p> <ul style="list-style-type: none"> a) Moisture content: [2 Marks] b) Other seeds count: [2 Marks] c) Purity analysis: [2 Marks] d) Germination capacity: [2 Marks] e) Vigour: [2 Marks]
6	<p>A breeder who develops a variety may acquire Plant Breeder's Rights (PBR). Justify importance of this Right and list conditions that must be met for the grant of the PBR. The variety should be:</p> <p>[10 Marks]</p>
7	<p>Seed varieties may be tested for Distinctness, Uniformity and Stability (DUS) and Value for Cultivation and Use (VCU) for the purpose of release. Explain these tests and distinguish the testing of the two.</p> <p>[10 Marks]</p>

-END-

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012/2013 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATIONS
6th MARCH 2013
AGE 421: PRODUCTION ECONOMICS

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS. EACH ONE IS WORTH 20%.

Question 1

- a. What is Production Economics and what are some of the questions or issues that it attempts to address in an agribusiness context?
- b. Draw and fully label the Classical Production Function, the Average Physical Product and Marginal Physical Product Curves. In your drawing, carefully describe the three stages of the production function, and also make a statement on the elasticity of production in each stage.

Question 2

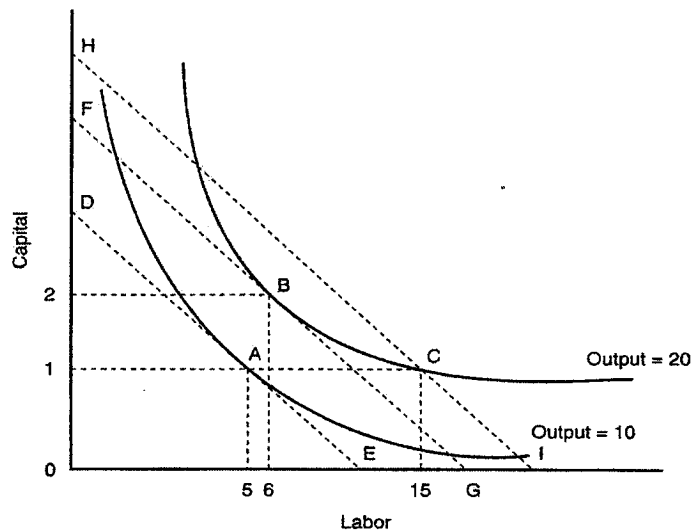
- a. Assume a firm is operating in a purely competitive market and that its input-output relationship is of the following form; $Y = X_1^{1/3} X_2^{1/3}$; $P_{X1} = \$1,000$, $P_{X2} = \$1,000$. There are no fixed costs. What type of production function is the firm faced with? At how many units of output, Y, will the firm maximize the net returns when the price of the product is \$27,000?
- b. For the production function $Y = 0.5X^\beta$
 - i. Prove that β is the elasticity of production.
 - ii. If $\beta = 1/2$, what are the MPP and APP when $X = 4, 9, 16$ and 25 .

Question 3

In the diagram below are isoquants for two output levels ($Q = 10$ and $Q = 20$ units) with the use of two variable inputs capital and labour. Also indicated in the diagram are three isocost lines; DE, FG and HI.

Critically analyze the diagram and answer the following questions;

- a. Define
 - i. An Isoquant
 - ii. An Isocost line
- b. Which points represent the optimal combination of the two variable inputs?
- c. What is the special name given to this optimal combination of the two variable inputs?
- d. What algebraic equation illustrates this optimal point?
- e. Given that a firm is operating along isoquant $Q = 10$, and wishes to expand its output to the higher isoquant, $Q = 20$; at what point along this isoquant should the firm expand to? Give an explanation for your answer.
- f. What is an isocline?
- g. What is an expansion path?
- h. What is the economic importance of isoclines and expansion paths?



Question 4

You are the farm Manager at Shiwan'gandu Farms. You currently have a total of 20 acres of farm land with various crop and animal production enterprises. The share holders of the farm have asked you to increase your production and profits. You can only do this by purchasing an additional 20 acres of land. You have identified a 20 acre piece of land and have been asked to pay KR 6,000 per acre. The seller of this land has further informed you that each acre of land will produce a constant return of KR 520 each year into time without end. As an investor, the farm Manager's discount rate is 6.5%.

- What is the maximum price the farm Manager should pay for each acre of land?
- Should the farmer go ahead and buy the piece of land? Show the necessary computations in support of your answer and the decision criteria the farmer would use.

Question 5

- Depreciation is made up of two components; Time Depreciation and Use Depreciation. Define these two types of depreciation and explain the main difference between the two?
- What does it mean when an agribusiness firm is said to be 'living off depreciation'?
- Your grand father is due for retirement and plans to start his own agribusiness. The company he works for has offered him a lump sum retirement payment of \$60,000 or a life time annuity of \$10,000 – whichever he chooses. Your grand father is not in good health and expects to live for an additional 5 years only. Which option should he choose, assuming that a 9% interest rate is appropriate to evaluate the annuity?

END OF EXAMINATION

The University of Zambia
University First Semester Examinations – February 2013

AGE 431
Linear Programming Applications for Agribusiness

Time: Three (3) hours

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

1. Mathematical programming (MP) is a very useful decision tool in agriculture and business. As briefly and as precisely as possible answer the following questions about MP.
 - a) Why do you think MP models are so important in business decisions? [4 points]
 - b) Linear programming (LP) is a special type of MP. List three other types of MP models and state how they differ from LP models. [6 points]
 - c) In research, LP fits within the framework of the scientific research process. Explain how LP fits into the scientific research process. [3 points]
 - d) All MP models have certain essential features/components. List the features/components of MP models. [4 points]
 - e) LP is always better than any other technique available to agricultural economists. True or false? Explain your answer. [3 points]
2. Use the following excerpt from the Excel Solver output to answer the questions below.

-----S-O-L-V-E-R--E-X-C-E-R-P-T--S-T-A-R-T-S-----

Constraints (from the answer report)

Cell	Name	Cell Value	Formula	Status	Slack
\$C\$5	Labour (months)	72	$\$C\$5 \leq \$D\5	Binding	0
\$C\$6	Land (ha)	20	$\$C\$6 \leq \$D\6	Binding	0
\$C\$7	Fertilizer (kg)	320	$\$C\$7 \leq \$D\7	Not Binding	280
\$E\$3	Maize	16.00	$\$E\$3 \geq 0$	Not Binding	16.00
\$F\$3	Wheat	4.00	$\$F\$3 \geq 0$	Not Binding	4.00

Adjustable Cells (from the sensitivity report)

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$E\$3	Maize	16.00	0.00	60	20	20
\$F\$3	Wheat	4.00	0.00	40	20	10

-----S-O-L-V-E-R--E-X-C-E-R-P-T--E-N-D-S-----

- a) Write out algebraically the objective function for this problem and compute its optimal value. [8 points]
- b) What is the optimal value of each of the real activities? [4 points]
- c) State the right-hand-side values for each of the resource constraints. [6 points]
- d) What is your expectation of the shadow price for fertilizer? [6 points]
- e) What additional information do you need to be able to demonstrate that Euler's Theorem holds for this problem? [6 points]

3. Palm Farms Limited (PFL), 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. PFL has 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 sorghum.
- Solve the primal model using the simplex method [10 points]
 - Set up the dual model in a tableau format [5 points]
 - Now, suppose that PFL wishes to allocate at least 5 ha of its land to the sorghum enterprise.
 - Set up algebraically the primal model for this problem [7 points]
 - Write out syntax for solving this problem in GAMS [8 points]
4. National Milling Company (NMC) formulates rations for different types of livestock. Suppose you have been hired to formulate the rations at the lowest possible cost. You have been given the following information about the available feedstock (ingredients).

Nutrient	Nutrient content and cost by type of ingredient		
	Maize meal (kg)	Soyabean cake (kg)	Sunflower cake (kg)
Protein (%)	9	51	12
Energy (Kcal/kg)	3,600	3,400	3,100
Lysine (%)	0.20	3.20	0.50
Weight (Tonne)	1	1	1
Cost (ZK/tonne)	1,000,000	2,000,000	900,000

Animal scientists have determined that the ration for a certain specified livestock must contain at least 14% protein, 3,300 kilocalories per kg (3,300 kcal/kg) of energy, and 0.5% lysine. Lysine, however, should not exceed 1.5%. You are required to produce exactly 1 tonne of the ration.

- Specify this cost-minimizing primal LP problem algebraically and in a tableau format
 - algebraically [8 points]
 - in a tableau [4 points]
- List all the unknown real and slack activities in the model? [8 points]

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2012 ACADEMIC YEAR FIRST SEMESTER EXAMINATIONS

COURSE: AGE 511 – AGRICULTURAL ORGANISATION AND ADMINISTRATION

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER QUESTIONS ONE AND ANY OTHER FOUR; EACH QUESTION IS WORTH 20 MARKS

- Q1. i) State and explain the characteristics Weber's theory on bureaucratic organization. (8 marks)
- ii) Outline the problems associated with the bureaucratic system. (6 Marks)
- iii) Discuss the different categories of managerial roles. (6 Marks)
- Q2. i) Discuss the various components in strategic planning. (10 Marks)
- ii) The way in which decisions are taken regarding alternative strategies is an important ingredient in strategic planning. As a manager in a newly established organization which you have joined discuss the four basic approaches you would use in strategic planning with your management team. (6 Marks)
- iii) Distinguish between programmed and non-programmed decision. (4 Marks)
- Q3. i) Discuss the disadvantages of matrix organization and with the aid of a well labeled diagram illustrates departmentation by function. (6 Marks)
- ii) Discuss the major external causes of miscommunication and communication difficulties in places of work. (6 Marks)
- iii) Distinguish between theory "X" and theory "Y". Give examples of their application

in real life situation. **(8 Marks)**

- Q4. i) What is motivation? Identify factors that determine worker's motivation. **(6 Marks)**
- ii) To manage individuals, you need to know how to communicate openly and honestly with your subordinates. Distinguish between coaching and counseling. **(6 Marks)**
- iii) What is an employee assistance programme (EAP) and what kinds of problems do an EAP address? **(8 Marks)**
- Q5. In order to gain an accurate picture of the morale of employees in an organization, you as a manager must not only understand their thinking, views and attitudes, but also get to know why employees leave the organization. Discuss some indicators of poor moral and how you would strive to obtain such information. You must also give factors that influence morale. **(20 Marks)**
- Q6. i) Explain the external staffing constraints which human resource managers are faced with when planning for human resource. (Do not just give a list). **(8 Marks)**
- ii) It is said that a successful and effective orientation programme must be employee centered. Discuss the important issues you would bring out to an employee during orientation. **(12 Marks)**

The University of Zambia
School of Agricultural Sciences
Department of Agricultural Economics and Extension
2012 Academic Year First Semester Final Examinations
AGE 531 International Agricultural Markets, Trade and Development

Date: Thursday, 14th March, 2013 – Morning

Venue: Other Rooms

INSTRUCTIONS

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

Section A

- 1) Distinguish multilateralism and regionalism as approaches to trade liberalization. Which approach is more likely to achieve global free trade? **(6 marks)**
- 2) Briefly describe the types of transactions that are recorded in the Financial Account section of a country's Balance of Payment record. **(6 marks)**
- 3) There is a popular myth that trade deficits are bad and trade surpluses are good. This however, is not always true. Specify the conditions under which a trade deficit can be good for a country's economy. **(6 marks)**
- 4) Briefly explain Purchasing Power Parity as a theory of exchange rate determination. **(6 marks)**
- 5) Briefly explain how international trade was viewed in mercantilism **(6 marks)**

Section B

- 6) Suppose Zambia produces two products, maize and clothing. The productivity of a unit of labor in maize production is 0.25 and 0.167 in the production of clothing. Productivity of a unit of capital is 0.5 in maize and 0.25 in clothing. The unit prices of maize and clothing in Zambia are Kr40 and Kr120 respectively.
- a) Which industry is labor intensive? (4 marks)
 - b) Which industry is capital intensive? (4 marks)
 - c) Specify the zero profit conditions in both industries (5 marks)
 - d) What are the equilibrium wage and rental rates? (5 marks)
 - e) Suppose the price of maize rises from Kr40 to Kr60,
 - i) What happens to the equilibrium wage and rental rates? (5 marks)
 - ii) Specify the magnification effect for prices (6 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 Kr1, 000 worth of fertilizer requires Kr500 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.

(15 marks)

Section C

EITHER

8) Mr. Ngoma is a fresh graduate from UNZA recently hired as an Economist by the National Economic Advisory Council to work on international trade policy issues. In his first assignment, he has been informed that the Rwandan government recently requested the Zambian government to consider effecting a trade policy measure that would limit the amount of sugar that Nakambala Sugar Plc exports to Rwanda. The Rwandan government envisions that this trade policy measure to be imposed by Zambia would be a critical step towards boosting Rwanda's domestic supply of sugar.

a) What trade policy tool should Mr. Ngoma propose to the Zambian government to implement given the scenario presented above? **(4 marks)**

b) Assuming Zambia is a large country in sugar exports, and that there are only two countries (Zambia and Rwanda), explain the price and welfare effects of this policy within Zambia, Rwanda and the world as a whole. **(22 marks)**

OR

9) Mrs. Mbuzi is a Zambian investor trying to decide if she should invest in a certificate of deposit (CD) in the United States of America (USA) or a certificate of deposit within Zambia.

a) Derive the formula for computing the rate of return of Mrs. Mbuzi investing in the USA certificate of deposit clearly showing all the steps and respective formulas. **(16 marks)**

b) Suppose Mrs. Mbuzi wishes to invest Kr2,000. Given the following:

Spot exchange rate = Kr5.2/USD

Expected exchange rate one year from now = Kr 5.4/USD

One-year interest rate on a CD in Zambia = 10%

One-year interest on a CD in the USA = 12%,

Calculate the rate of return on:

- i) the certificate of deposit in the USA (5 marks)
- ii) The certificate of deposit in Zambia (5 marks)

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012/2013 ACADEMIC YEAR FIRST SEMESTER 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

1. a) Why are "with" and "without" comparisons important in project analysis as opposed to the "before" and "after" comparisons? (4 marks)
b) Describe and illustrate by use of diagrams the "with" and "without" project comparisons obtaining in four different scenarios. (8 marks)
c) Sometimes agricultural project analyses prove wrong because of project design and implementation. Briefly explain four problems that have been shown to be related to project design and implementation. (8 marks)
2. a) Why is choosing a discount rate important in project analysis? Describe and explain briefly the discount rates that can be used in both financial and economic analysis. (14 marks)
b) How do you go about valuing intangible costs and benefits in economic analysis? (6 marks)
3. The following investment outlay, operation and maintenance costs (cash outflows) as well as gross benefits (cash inflows) are given for a coffee production and processing project proposal:

Amounts in Kr' 000				
Year	Investment Outlay	Operation and maintenance	Production Cost	Gross Benefit
1	350	0	0	0
2	300	0	0	0
3	150	0	0	0
4	100	0	0	0
5	100	0	0	0
6	0	20	40	660
7	0	20	50	670
8	0	20	60	680
9	0	20	70	790
10	0	20	80	800

- 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) If a 2 year delay in project implementation reduces the net present value of the project's benefits to Kr+4,000 whereas a 3 year delay reduces the net present value to Kr-6,000, what is the magnitude (switching value) of the project's delayed implementation before the net present value falls below unacceptable level? Explain your answer. (4 marks)

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

Year	Foreign Exchange Component (US\$'000)			Domestic Currency Component (Kr'000)	
	Value of Production	Investment Cost	Production Cost	Investment Cost	Production Cost
1	0	80	0	450	0
2	0	120	0	400	0
3	0	150	0	300	0
4	180	0	100	250	130
5	400	0	200	0	160
6	550	0	300	0	160
7	600	0	300	0	160
8	600	0	300	0	160
9	600	0	300	0	160
10	600	0	300	0	160

a) If the opportunity cost of capital is 20%, compute the domestic resource cost (DRC). If the official exchange rate (OER) is Kr 5.20 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? (5 marks)

c) Explain why it is important to estimate the DRC and for what type of projects it should be applied? (5 marks)

5. The following information is given for a centre pivot to be imported into the country: the c.i.f. price is US\$105,000; the import levy is 5% of the c.i.f. price; the handling and clearing charges amount to K10,000 and the transportation to the project site is K5,000. The official exchange rate (OER) is K5.2 to US\$1 and a foreign exchange premium of 20% is estimated.

a) Calculate the economic import parity value at the farm gate or project boundary using the conversion factor approach. (8 marks)

b) Calculate the economic import parity value at the farm gate or project boundary using the shadow exchange rate approach. (8 marks)

c) Why is it important to allow for a foreign exchange premium when calculating the economic import parity value? (4 marks)

END OF EXAMINATION

The University of Zambia
School of Agricultural Sciences
2011/2012 Academic Year Second Semester
Final Examinations
AGE 6062: Production Economics
Time: Three (3) Hours

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

1. Answer the following questions as concisely as possible.
 - a) Sune Carlson contends that four forces interact to effectively determine the actions of profit-maximizing firms. Briefly discuss the four forces. [8 points]
 - b) Briefly explain why agricultural economists study production economics [6 points]
 - c) A convex isoquant implies that a rise in x_1 (the factor on the x-axis) accompanied by a fall in x_2 would result in a rise in MPP_2 , a fall in MPP_1 , and, therefore, a fall in the marginal rate of technical substitution. Comment. [6 points]

2. Sally Street has a small business in which she clears red cedar from pasture land. She operates as a price taker. The prevailing price for clearing cedars is \$20 per acre. Her costs are given by

$$C(q) = 0.1q^2 + 10q + 50$$

where q is the number of acres Sally chooses to clear.

- a) Derive the average variable cost, fixed cost, and marginal cost functions [6 points]
 - b) How many acres should Sally clear to maximize profit? [8 points]
 - c) Calculate Sally's profit. [4 points]
 - d) Derive her supply curve. [6 points]
 - e) What is the price elasticity of her supply curve at equilibrium? [3 points]
 - f) What is the minimum price of q at which she will operate in the short run? [3 points]
3. Consider the following production function:

$$q(x_1, x_2) = 100x_1 - 2x_1^2 + 50x_2 - x_2^2$$

- a) Determine if the function is strictly concave. [6 points]
 - b) Derive the expansion path. [4 points]
 - c) Derive the factor demand for x_1 . [4 points]
 - d) Use comparative statics to determine the following: [12 points]
 - i) the impact of changes in the price of x_1 on x_1 ,
 - ii) the impact of changes in the price of x_2 on x_1 , and
 - iii) the impact of changes in the price of output on x_1 .
 - e) Derive the isoquant equation. [4 points]

4. Given the following production function

$$q(x) = 3x^2 - \frac{1}{2}x^3$$

in which x is the number of workers employed. The price of output q is $p = 75$ and the cost of hiring a worker is $r = 100$.

- a) Assume that the objective of a private firm is to maximize returns to the fixed factors of production. Derive the optimal number of workers for a private firm. [8 points]

- b) Assume that the objective of a cooperative is to maximize the average output $\left[\frac{q(x)}{x} \right]$ per worker.

What is the optimal number of workers for the cooperative with this production function?

- c) Which firm employs more workers? Will this generally be the case? Explain. [8 points]
[4 points]

**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2011/12 ACADEMIC YEAR SECOND SEMESTER
FINAL EXAMINATIONS**

AGE 6131: PROJECT PLANNING & MANAGEMENT

TIME: THREE HOURS

INSTRUCTIONS:

- 1) Answer all questions**
 - 2) Leave the discount tables in the Examination Hall**
-

- 1 "Many projects aimed at change in agriculture can therefore be seen in relation to development". (Van Rooyen). Describe and comment on the suggested useful and functional classification of development projects. (25 marks)
2. A proposed project to produce ethanol from cassava will involve a phased implementation plan with an estimated total project cost of K1.0 billion. The projected capital investment outlays, operation and maintenance costs and production costs as well as gross benefits are indicated in the following table:

Amounts in K'million				
Year	Cost of Capital Items (Investment)	Operation and Maintenance Costs	Production Costs	Gross Benefits
1	200	0	0	0
2	250	0	0	0
3	250	0	0	0
4	200	0	0	0
5	100	0	0	0
6		30	40	570
7		30	60	690
8		30	70	800
9		30	80	910
10		30	90	1020

- a) Compute the Net Benefit – Investment (N/K) ratio if the opportunity cost of capital is 20%. On the basis of the N/K ratio you obtain, would you recommend the project as good investment? Explain why? (8 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? (12 marks)
- c) If a 2 year delay in project implementation reduces the net present value of the project's benefits to K+20,000 whereas a 3 year delay reduces the net present value to K-30,000, what is the magnitude (switching value) of the project's delayed implementation before the net present value falls below unacceptable level? Explain your answer. (5 marks)
3. Define and elaborate on the purposes of Monitoring and Evaluation in project management. Comment on the distinction between conventional evaluation and participatory evaluation. (25 marks)
4. Write short notes on the following:
- a) Cost-Benefit Analysis (CBA) in public sector vs. profit determination in private sector (5 marks)
 - b) Tradable goods vs. Non-tradable goods. (5 marks)
 - c) Independent projects vs. Mutually Exclusive projects . (5 marks)
 - d) Bar and Gantt Charts vs. Network Diagrams. (5 marks)
 - e) Sensitivity Analysis vs. Switching Value (5 marks)
-

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION EDUCATION

FINAL EXAMINATION AGE 6211 AGRICULTURAL POLICY ANALYSIS

SEMESTER 2

INSTRUCTIONS

Please read the instructions carefully

This examination is divided into two parts: Section One and Two. Section one has two compulsory questions each with a total of 30 points giving possible score in this section of 60 points. Section two has four questions and a student has the option to choose only two. Each question in this section has a total of 20 points giving a possible total score of 40 points. Please allocate your time wisely.

Question ONE (Total 30 points)

Part A

The government has established an input support program aimed at **increasing farmers' income, enhancing the private sector participation in the input market and reducing the incidence of poverty** in rural areas through these subsidized inputs. This program involves the direct distribution by the government of subsidized inputs (fertilizer and seed) to selected farmers through government selected Agents (a few selected fertilizer and seed suppliers). Please explain how this program could or could not achieve the stated aims and objectives:

Part B

You are now an economist who recently was hired by government. You have been thoroughly trained in the theory of consumer choices. You have observed that the selected farmers who were allocated these inputs (Fertilizers and Seed) have started selling these inputs on to the market.

Similarly the minister is unhappy following this revelation. You have now been tasked to explain as an economist this development in the market using your training in consumer choice theory.

Part C

Could you also suggest some appropriate models which the minister could consider which might alleviate these market inconsistencies or at least make the program more efficient?

Question TWO (Total 30 points)

Part A

The government has established a state company to market the farm produces for farmers. This State Company has been fully funded to buy at least three quarters of the crop on to the market. In the middle of the marketing season a group of private sector traders also involved in buying of the crops confront the government minister complaining of unfair treatment in the market. You are now an economist who has recently been hired to advise the minister. Could you explain what is happening in this market using your rigorous training in economics?

Part B

Given the fact that the government is committed to the general policy of market liberalization, could you suggest the best options the government could or could not take to enhance competition in the market?.

Part C

In addition, this state company has been buying the crop at a relatively higher price than the market could offer in order to support the farmers' incomes but it has been observed through a state information system survey that instead of poverty levels going down the levels are going up implying that the farmers are getting worse off . What could be causing this contradiction in policy? Please argue using the winners and losers approach 'it could also help to segment the categories of farmers in this analysis.

SECTION TWO

Please choose only two questions from this section

Total of 40 points

Question 3 (Total 20 points)

Part A

The economy has just received a very large injection of unforeseen foreign exchange in the market. What could possibly happen with this scenario versus the local currency? Could you explain what effect this could have on the agricultural exports and imports in the short, medium and long run?

Part B

The economy has just rebased its currency. What are the effects of this policy change to the agricultural sector?

Question 4 (Total 20 Points)

Part A

Country A has been exporting maize to country B for over 10 years. As a result of poor harvest in the eleventh year country A has suffered a shortfall in food production and consequently imposed a ban on exports of food to country B. Country C on the other hand has always had a deficit in maize but ironically has been exporting to Country B competing with country A. What are the implications of country A's ban on maize export to its farmers, to the overall market of food and to country C. Please discuss country A's implications using both the short run and long run implications?

Part B

What other options could have been applied to achieve a similar objective of securing national food security for country A.

Question 5 (Total 20 Points)**Part A**

You are a manager of a busy farm growing chickens. Your aim is to maximize profit function $\Pi = TR - TC$ Where TR is the Total revenue and TC is total costs. This firm wants to maximize the produce of the farm. Please derive a functional form which would maximize the proceeds of this farm?

Part B

The Total Revenue (TR) is given as follows $TR = P(Q^2 - 40)$ and the Total Cost $TC = P(40Q)$ The Q in this case being the number of chickens raised and P being the price of chickens. If P is given as K30 in a recently rebased currency. Please find the level of Q which maximize this farm produce. Please show the equations. What would be the maximum level of profit for this firm?

Question 6 (Total 20 points)**Part A**

Please discuss the possible social and economic contribution of the agricultural sector to the economy?



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2011/2012 ACADEMIC YEAR SECOND SEMESTER EXAMINATIONS
AGE 6311 AGRIBUSINESS MANAGEMENT

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS.

Question 1

(a) In light of the challenges facing agribusiness firms in Africa, explain and elaborate what management is. Clearly identify and define the five (5) major management functions? Elaborate by citing an example of a specific activity related to performing each of the functions you have identified.

(b) Describe and explain the sole tradership and partnership types of business enterprises. What are some of their advantages and disadvantages when seen from the viewpoint of a proprietor or manager?
[30 Marks]

Question 2

(a) What is a business plan? Explain the need for or benefits of a business plan from the perspectives of both internal and external users

(b) List practical suggestions to follow in writing a business plan, and outline and briefly explain the contents of key sections of a business plan.
[30 Marks]

Question 3

(a) In defining the basic principles of management, textbooks often list Planning and Control as two separate and distinct functions. What is the relationship between control and planning?

(b) What are the basic steps in the Control process? Identify and explain the key considerations in each step.
[15 Marks]

Question 4

Write brief notes to explain the **salient aspects** of the following. Use relevant examples from agribusiness to illustrate the concepts:

- (i) Matrix Organization
- (ii) Marketing Mix
- (iii) Bases of leadership power
- (iv) Maslow's motivation theory
- (v) Human Resource Management

[25 Marks]

END OF EXAMINATION

[Total - 100 Marks]

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012/13 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION
AGF 341 – Technical Thermodynamics

Instructions:

Answer **Five (5)** questions; answer **question 1** and **any other 4**.

All questions carry equal marks

Marks allocated for each question are indicated at the end of each question

Useful formula and constants are listed on the last page

Time allowed: Three (3) Hours

- Q.1 A refrigerator uses refrigerant-134a as a working fluid and operates on an ideal vapour-compression refrigeration cycle between 0.12 and 0.7MPa. If the mass flow rate of the refrigerant is 0.05kg/s, Show the cycle on a T-s diagram with respect to saturation lines and determine:
- a. the rate of heat removal from the refrigerated space [6]
 - b. the power input to the compressor [6]
 - c. the rate of heat rejection to the environment [6]
 - d. the COP of the refrigerator [2]
- Q.2
- a. An automobile engine consumes fuel at a rate of 28L/h and delivers 60kW of power to the wheels. If the fuel has a heating value of 44,000 kJ/kg and a density of 0.8g/cm³, determine the efficiency of this engine. [10]
 - b. An ordinary egg can be approximated as a 5,5cm-diameter sphere. The egg is initially at temperature of 8°C and is dropped into boiling water at 97°C. Taking the properties of the egg to be $\rho = 1020\text{kg/m}^3$ and $c_p = 3,32\text{kJ/(kg K)}$, determine:
 - i. how much heat is transferred to the egg by the time the temperature of the egg rises to 70°C. [7]
 - ii. the amount of entropy generation associated with this heat transfer process. [3]
- Q.3
- a. A household refrigerator that has a power input of 450W and a COP of 2.5 is to cool five large watermelons, 10kg each, to 8°C. If the watermelons are initially at 20°C and have a specific heat of 4.2 kJ/kg. °C. Determine:
 - i. how long it will take for the refrigerator to cool them [3]
 - ii. explain whether your answer is realistic or optimistic [3]

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012/13 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION
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 - i. how long it will take for the refrigerator to cool them [3]
 - ii. explain whether your answer is realistic or optimistic [3]

- b. b. A heat pump is used to maintain a house at a constant temperature of 23°C . The house is losing heat to the outside air through the walls and windows at a rate of 60,000 KJ/h while the energy generated within the house from the people, lights and appliances amounts to 4000 kJ/h. For a COP of 2.5, determine the required power input to the heat pump. **[4]**
- c. An inventor claims to have developed a refrigerator that maintains the refrigerated space at 2°C while operating in a room where the temperature is 24°C and that has a COP of 13.5. Is this claim reasonable? **[4]**
- d. Refrigerant-134a is throttled from the saturated liquid state at 800kPa to a pressure of 140kPa. Determine:
 - I. the temperature drop during this process **[3]**
 - II. the change in entropy during this process **[3]**

Q.4

- a. Explain the principle of a pressure cooker and give its advantages. **[8]**
- b. Describe with illustrations, the ideal cycle for a spark-ignition engine and state its application in the food industry. **[12]**

Q.5

- a. Define a reversible process and describe its main features. **[6]**
- b. Explain and illustrate the Actual Vapour Compression Refrigeration cycle and its application in the food industry. **[14]**

Q.6

- a. Compare and contrast an open and a close system and give an example for each case. **[7]**
- b. State the second law of thermodynamics according to Kelvin-Planck. Explain and illustrate its application. **[7]**
- c. Explain the principle of evaporative cooling and its application in the food industry. **[6]**

End of Exam & Good Luck!!!

Data

$$Q = \Delta U + W$$

$$\text{COP}_{\text{HP}} = Q_H / (Q_H - Q_L)$$

$$\text{COP}_{\text{HP}} = Q_H / W$$

$$\text{COP}_R = Q_L / W$$

$$\eta_{\text{th}} = W / Q_H$$

$$\Delta H = mc_p \Delta T$$

$$V = 4/3 \pi r^3$$

$$m = \rho v A$$

$$\theta = h + v^2/2 + gz$$

$$Q_{\text{in}} + W_{\text{in}} + \sum m_i \theta_i = Q_{\text{out}} + W_{\text{out}} + \sum m_e \theta_e$$

$$S = S_f + x S_{\text{fg}}$$

$$\Delta S_{\text{syst}} = Q / T_{\text{sys}}$$

$$W = m(h_1 - h_2)$$

$$P_1 V_1 / T_1 = P_2 V_2 / T_2$$

$$\Delta s = mc_v \ln(T_2 / T_1)$$

$$\Delta s = mc_p \ln(T_2 / T_1)$$

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012 ACADEMIC YEAR FIRST SEMESTER
FINAL EXAMINATIONS

AGF 411: UNIT OPERATIONS IN FOOD ENGINEERING I

TIME: THREE HOURS

INSTRUCTIONS:

Please read the instructions and each question carefully. Answer **ALL** questions. **ALL** questions carry equal marks. Some formulae are provided on the last page.

-
1. A filtration test was carried out, with a particular product slurry, on a laboratory filter Press under a constant pressure. The area of the laboratory filter was 0.186 m^2 and volumes of filtrate were collected as follows:

Filtrate volume (kg) (V)	20	40	60	80
Time (min) (t)	8	26	54.5	93

By using the filtration equation $t / (V/A) = [\mu r w / 2 \Delta P] \times (V/A) + \mu r L / \Delta P$

- Plot a filtration graph **(12 marks)**
- Calculate the slope and the intercept. **(4 marks)**
- In the filtration of a certain colloidal food material the initial period is affected at a constant rate with the feed pump at full capacity until the pressure reaches 400 kN/m^2 . The pressure is then maintained at this value for the remainder of the filtration. The constant rate operation requires 900 s, and one-third of the total filtrate is obtained during this period. Neglecting the resistance of the filter media, determine the total filtration time **(9 points)**

2. a) The **power law equation** $\tau = k(dv/dz)^n$ is a deviation from Newton's equation so that the general equation can be applicable to those types of fluids that do not conform to the simple relationship of the equation proposed by Newton which is $\tau = \mu(dv/dz)$
- Give one fluid that obeys the equation $\tau = \mu(dv/dz)$ (1 mark)
 - Use the power law equation to define the different types of **fluids** with examples. (9 marks)
 - Why is it important to know what type of fluid you are working with in food processing? (3 marks)
- b) It has been reported that about 70% of food products are in solid form.
- Why is it important to study particle technology? (3 marks)
 - Why is the study of particles important in unit operations such as storage and during formulations and mixing? (3 marks)
 - What is pneumatic conveying? (2 marks)
 - Give at least 4 characteristics of a pneumatic conveying system. (4 marks)
3. In the process of producing concentrated juice, a fresh extracted and strained juice containing 10 % solids is evaporated in the first evaporator, giving 18 % solids in the juice. This is fed to a second evaporator, which gives 50 % concentrated juice as a final product.
- Draw and clearly label the process flow diagram (6 points)
 - Calculate the water removal from each evaporator (6points)
 - Calculate the amount of product produced (concentrated juice) (6 points)
 - A 20% sucrose solution flows from a mixing tank at 50kpa through a horizontal pipe 5 cm in diameter at 3.54m/s. The diameter reduces to 3 cm and its velocity changes respectively to 9.81m/s. Density of sucrose solution is 1070 kg/m³. Calculate the new pressure in the pipe. (4 marks)
 - Differentiate between a unit operation and a unit process with examples. (3 marks)

4. A dispersion of oil in water is to be separated using a centrifuge. Assume that the oil is dispersed in the form of spherical globules 5.1×10^{-5} m diameter and that its density is 894 kg m^{-3} . If the centrifuge rotates at 1500 rev/min (N) and the effective radius at which the separation occurs is 3.8 cm. take the density of water to be 1000 kg m^{-3} and its viscosity to be $0.7 \times 10^{-3} \text{ N s m}^{-2}$.
- Calculate the velocity of the oil through the water. (5 marks)
 - What are the limitations of stokes law? (4 marks)
 - Does the above situation comply with stokes law? (4 marks)
 - What are the three basic designs of pneumatic transport systems and what differentiates them? (12 marks)

END

List of equations

$$P = F/A = Ps + Z \rho g$$

$$P = Z \rho g$$

$$\rho_1 A_1 v_1 = \rho_2 A_2 v_2$$

$$D^2 N^2 r (\rho_p - \rho_f) / 1640 \mu$$

$$t / (V/A) = [\mu r w / 2 \Delta P] \times (V/A) + \mu r L / \Delta P$$

$$v_1^2 / 2 + P_1 / \rho_1 = v_2^2 / 2 + P_2 / \rho_2$$

$$E_{p1} + E_{k1} + E_{r1} = E_{p2} + E_{k2} + E_{r2} + E_f - E_c$$

$$Z_1 g + v_1^2 / 2 + P_1 / \rho_1 = Z_2 g + v_2^2 / 2 + P_2 / \rho_2 + E_f - E_c$$

$$Z_1 g + v_1^2 / 2 + P_1 / \rho_1 = Z_2 g + v_2^2 / 2 + P_2 / \rho_2$$

$$v_m = D^2 g (\rho_p - \rho_f) / 18 \mu$$

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012/2013 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

AGF 421 – Principles of Food Technology I

Instructions:

Answer all questions in section A. In section B answer question 3 and any other two. Indicate the questions you have answered in the provided answer sheet.

Time allowed: Three (3) Hours

SECTION A

Answer all questions in this section. Each question carries 10 marks.

1. Define the following terms:
 - a. Thermal conductivity
 - b. Steam economy
 - c. Emissivity
 - d. Relative humidity
 - e. Cooling load
2. Write short notes on each of the following:
 - a. Air blast freezers
 - b. Contact freezers
 - c. Falling period
 - d. Cold smoking
 - e. Hot smoking

SECTION B

Answer question 3 and any other two questions in this section. Question 3 carries 30 marks while the rest carries 25 marks each.

3. You are given a liquid feed to be concentrated from 11% to 75% in a single phase evaporator. The flow rate of the feed is 0.67 kg/s and it is introduced at a temperature of 43.3°C. It boils in the evaporator at 62.2°C. The steam is introduced in the evaporator at a pressure of 313 kPa. Given that the overall heat transfer coefficient (U) is equal to 943 W/m²°C and that the specific heat capacity of liquid food is 3.9 kJ/kg°C and the specific heat capacity of the product is 2.3 kJ/kg°C. Calculate:

- i. The amount of steam required
 - ii. The amount of the product produced
 - iii. The steam economy ($\frac{m_w}{m_s}$)
 - iv. The area you require for this process
4. The cold storage wall measuring 3 m x 6 m is constructed of a 15 cm thick concrete wall ($k = 1.37 \text{ W/m}^\circ\text{C}$). Insulation must be provided to maintain a heat transfer rate through the wall at or below 500 W. If the thermal conductivity (k) of insulating material is $0.04 \text{ W/m}^\circ\text{C}$, compute the required thickness of this material. It is given that the outside surface temperature is 38°C whereas the inside temperature is 5°C .
 5. 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 .
 - a. Calculate the work done (Q_w) on the refrigerant during isentropic compression
 - b. 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
 - c. Calculate the coefficient of performance (C.O.P)
 6. Using the psychrometric chart, calculate the following:
 - a. The absolute humidity of air which has 40% relative humidity (RH) and a dry-bulb temperature of 65°C .
 - b. The RH of air having a wet bulb temperature of 35°C and a dry bulb temperature of 70°C
 - c. The dew point of cooled adiabatically from a dry-bulb temperature of 90°C and 10% RH

END

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2012/2013 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

AGF 431 – Fundamentals of Biochemical Engineering

Instructions:

Question 1 is compulsory. Besides question 1, answer any other four questions. Indicate the questions you have answered in the provided answer sheet. Note that, some formulae are provided on the last page.

All questions carry **20 marks each**

Time allowed: **Three (3) Hours**

Question 1 (Compulsory).

Chemostat study was performed with yeast. The medium flow rate was varied and the steady-state concentration of cells and glucose in the fermenter were measured and recorded. The inlet concentration of glucose was set at 100 g/L. The volume of the fermenter contents was 500 L. The inlet stream was sterile.

Flow rate (mL/h)	Cell concentration, C_x (g/L)	Substrate concentration, C_s (g/L)
31	5.97	0.5
50	5.94	1.0
71	5.88	2.0
91	5.76	4.0
200	0	100

- a. Using the provided graph paper, evaluate the Monod kinetic parameters and then find the rate equation of cell growth
 - b. What should be the range of the flow rate to prevent washout of cells?
-
1.
 - a. Biotechnology provides both products and services. Give two examples of products and two examples of services that are derived by use of biotechnology
 - b. List four disadvantages of a biological process
 - c. Define enzyme immobilisation? State two advantages of using the technique of enzyme immobilisation
 - d. Define the term productivity
 - e. Differentiate yield coefficient from productivity

3. Suppose you have a microorganism that obeys the Monod equation:

$$\frac{dC_X}{dt} = \frac{\mu_{\max} C_S C_X}{K_S + C_S}$$

Where $\mu_{\max} = 0.7 \text{ h}^{-1}$ and $K_S = 5 \text{ g/L}$. The cell yield ($Y_{X/S}$) is 0.65). You want to cultivate this microorganism in either one fermenter or two in series. The flow rate and the substrate concentration of the inlet stream should be 500 L/h and 85 g/L, respectively. The substrate concentration of the outlet stream must be 5 g/L. Calculate:

- The maximum productivity
 - The optimum substrate concentration
4. Two continuous stirred-tank fermenters are connected in series, the first having an operational volume of 100 L and that of the second being 50 L. The feed to the first fermenter is sterile and contains 5000 mg of substrate, being delivered to the fermenter at 18 L/h. If the microbial growth can be described by the Monod kinetic model with $\mu_{\max} = 0.25 \text{ h}^{-1}$ and $K_S = 120 \text{ mg/L}$, calculate the steady-state substrate concentration in the second vessel.
5. From a series of batch cultures differing in their initial growth limiting substrate concentration, the initial reaction rates (r) were determined and the following data was obtained.

Substrate concentration (mmol/L)	Initial reaction rate (mmol/Lmin)
1	0.20
2	0.22
3	0.30
5	0.45
7	0.41
10	0.50
15	0.40
20	0.33

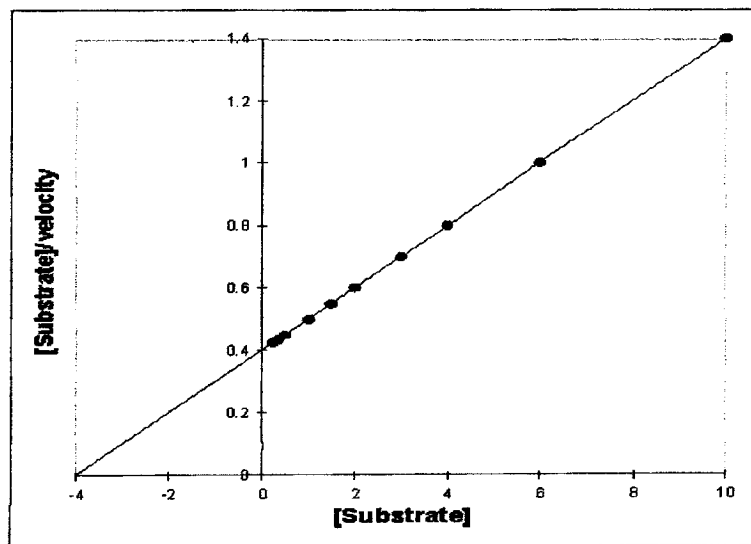
Using the provided graph paper, evaluate the Michaelis-Menten kinetic parameters by employing the Eadie-Hofstee plot.

6.a. Define the following terms:

- i. Specific growth rate
- ii. Doubling time

b. Derive an equation to show the relationship between the biomass concentration and substrate concentration

c. The figure below shows a graphical representation of enzyme kinetics.



(i) What plot is depicted by the graph above?

(ii) What are the values for the kinetic parameters K_m and r_{max} ? Show how you obtain these values.

END

FORMULAE LIST

$$C_S = \frac{K_S}{\tau_m \mu_{\max} - 1} \quad Y = \frac{C_X - C_{X_0}}{C_{S_0} - C_S} \quad D_2 = \frac{\mu_2 C_{X_1}}{C_{X_2} - C_{X_1}}$$

$$\frac{1}{r} = \frac{1}{r_{\max}} + \frac{K_M}{r_{\max}} \frac{1}{C_S} \quad C_S = \frac{DK_S}{\mu_{\max} - D} \quad C_X = Y \left(C_{S_0} - \left[\frac{DK_S}{\mu_{\max} - D} \right] \right)$$

$$r = r_{\max} - K_M \frac{r}{C_S} \quad D = \frac{\mu_{\max} C_S}{K_S + C_S} \quad D = \mu = \frac{1}{\tau_m} = \frac{\mu_{\max} C_S}{K_S + C_S}$$

$$K_M \ln \frac{C_{S_0}}{C_S} + (C_{S_0} - C_S) = r_{\max} t \quad r_P = \frac{r_{\max} C_S}{K_M + C_S} \quad C_{X,opt} = Y C_{S_0} \frac{\alpha}{\alpha + 1}$$

$$\frac{C_X}{\tau_m} = r_X = \frac{\mu_{\max} C_S C_X}{K_S + C_S} \quad \alpha = \sqrt{\frac{K_S + C_{S_1}}{K_S}} \quad C_{S,opt} = \frac{C_{S_0}}{\alpha + 1}$$

$$\tau_{m,opt} = \frac{\alpha}{\mu_{\max} (\alpha - 1)} \quad \frac{1}{\mu} = \frac{K_S}{\mu_{\max}} \frac{1}{C_S} + \frac{1}{\mu_{\max}} \quad C_{X_1} = Y \left\{ C_{S_0} - \frac{D_1 K_S}{\mu_{\max} - D_1} \right\}$$

$$(\mu_{\max} - D_2) C_{S_2}^2 + \left\{ \frac{D_1 D_2 K_S}{\mu_{\max} - D_1} - D_2 K_S - \mu_{\max} C_{S_0} \right\} C_{S_2} + \frac{D_1 D_2 K_S^2}{(\mu_{\max} - D_1)} = 0 \quad \frac{C_S}{r} = \frac{K_M}{r_{\max}} + \frac{C_S}{r_{\max}}$$

$$C_{S_1} = \frac{D_1 K_S}{\mu_{\max} - D_1} \quad \frac{C_{S_0} - C_S}{C_X} = \frac{K_S}{YD} + \frac{1}{Y} \quad \frac{\mu_{\max} C_S}{K_S + C_S} = YD \frac{(C_{S_0} - C_S)}{C_X}$$

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2012 ACADEMIC YEAR FIRST SEMESTER
FINAL EXAMINATIONS

AGF 441: WATER AND FOOD WASTE TREATMENT

TIME: THREE HOURS

INSTRUCTIONS:

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

1. Drinking water comes from surface water and ground water.
 - a) Outline the treatment steps commonly used for the treatment of surface water (10 marks).
 - b) Apart from Disinfection (chlorination/ozonation), describe 4 other types of water treatment (8 marks).
 - c) Explain how chlorine disinfection works (3 marks).
 - d) Define chlorine demand and breakpoint chlorination (4 marks).
2. Food processing effluents are a complex mixture of floating, settleable, suspended and dissolved materials. Treatment of these effluents therefore involve four types of treatment which are preliminary, primary, chemical and secondary treatments. Activated sludge system is a secondary treatment process.
 - a) What does the term, *activated sludge*, refer to? (2 marks)
 - b) Define the following terms used in activated sludge system (10 marks)
 - i) Hydraulic Residence Time

- ii) Sludge production
 - iii) Sludge Age
 - iv) Sludge Loading rate
 - v) Volumetric Loading rate
 - c) Discuss 3 problems encountered in activated sludge system and state what can be done to rectify each problem **(9 marks)**.
 - d) Give 4 recovery products from activated sludge systems **(4 marks)**.
3. Genetically modified organisms or GMOs are living organisms that have been altered through genetic engineering.
- a) Discuss in detail, the tools that are used in genetic engineering **(12 marks)**
 - b) Discuss in detail the process design for composting system **(13 marks)**
4. a) A design engineer approaches you in regard to the use of a trickling filter system for the cleaning of waste. As a food engineer, what advice would you give him as regards to:
- i. Designing the trickling filter **(9 marks)**
 - ii. Possible problems when using the trickling filter system and how they can be avoided. **(12 marks)**
- b. How has the developing world managed in dealing with waste management at household level? **(4 marks)**
5. In a food processing plant, equipment should be designed to ensure less contamination of the product.
- a) State the requirements of the surface finish in the design of equipment **(3 marks)**.
 - b) Apart from the surface finish, list and discuss the 5 other aspects to look at when designing equipment **(10 marks)**.
 - c) What ingredients will you use for cleaning and discuss how their efficiency can be determined. **(12 marks)**

END

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2012/13 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION
AGF 511 – Unit Operations in Food Engineering II

Instructions:

Answer **all** questions.

All questions carry equal marks.

Answer **sections 1 and 2 in separate booklets.**

A list of useful information is on the last page.

Time allowed: Three (3) Hours

SECTION 1

1. a) 0.01 Kg of steam with a specific enthalpy of 2,700 kJ/kg is mixed with 2.0 kg of dry air with a specific enthalpy of 20 kJ/kg. Determine the specific enthalpy of the mixture? **[10 marks]**
b) Moist air has a dry-bulb temperature of 30°C, and a wet-bulb temperature of 20°C. Use a psychrometric chart to find
 - i. The percentage saturation
 - ii. The moisture content
 - iii. The enthalpy
 - iv. The specific volume
 - v. The dew-point temperature **[10 marks]**
2. Moist air at 25°C dry-bulb and 50% saturation undergoes a process so that its condition is changed to 40°C dry-bulb and 30% saturation.
 - a) Use the psychrometric chart to determine the change in specific enthalpy for the process. **[5 marks]**
 - b) In another set of condition, the air inside a room during winter is at 20°C dry-bulb temperature and 40% saturation. If the temperature of the inside surface of the window is 9°C, will there be condensation on the window pane? **[5 marks]**

c) Describe the drying mechanism and state 5 different types of driers and give your selected choice. **[10 marks]**

3. a) Describe in detail the industrial application of distillation in processing of Scotch and Irish whiskey **[10 marks]**

b) Describe the industrial extraction of edible oil using food grade hexane and the stage at which distillation is applied **[10 marks]**

SECTION 2: Answer this section in a separate booklet.

1. A salt solution with 35% Na_2CO_3 is cooled to 20°C and crystallizes as a decahydrate. An amount of 5% of the original solution evaporates during cooling. For a yield of 90% $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ crystals;

a. Calculate the feed solution if the solubility at 20°C is 21.5kg anhydrous Na_2CO_3 /100kg total water. **[10 marks]**

b. Calculate the amount of crystals of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ in kg. **[2 marks]**

c. Discuss the role of super-saturation in crystallisation and how this influences the choice of crystallizers by giving at two (2) examples.

[8 marks]

2. A single-effect evaporator is concentrating a feed solution of organic colloids from 5 to 50 wt %. The solution has a negligible boiling-point elevation. The heat capacity of the feed is $c_p = 4.06 \text{ kJ/kg.K}$ and the feed enters at 15.6°C . Saturated steam at 101.32 kPa is available for heating, and the pressure in the vapour space of the evaporator is 15.3 kPa. A total of 4236 kg/h of water is to be evaporated. The overall heat-transfer coefficient is $1988 \text{ W/m}^2.\text{K}$. Calculate:

a. the required surface area **[6 marks]**

b. the steam consumption **[6 marks]**

- c. A fruit juice manufacturer informs you that he is using a horizontal-type natural circulation single effect 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 with cost and quality implication considerations. **[6 marks]**
- d. Briefly explain the function of a condenser and give one example. **[2 marks]**

End of Examination – Good Luck!!!!

Data for the Examination

$$F = D + B$$

$$x_D / R_D + 1$$

$$R_m / R_m + 1 = (x_D - y') / (x_D - x')$$

$$R_m = (x_D - y') / (y' - x')$$

$$q = 1 - f$$

$$- q / 1 - q$$

$$q = 1 + \frac{C_{pL} (T_b - T_F)}{\lambda}$$

$$q = - \frac{C_{pV} (T_F - T_d)}{\lambda}$$

$$L_o + V_2 = L_1 + V_1 = M$$

$$x_{si} = p / (p + 1)$$

$$C_p = 1.424 m_c + 1.549 m_p + 1.675 m_f + 0.837 m_a + 4.187 m_m$$

$$C_p = 1.675 + 0.025 w$$

$$\Delta H = mc (T_2 - T_1)$$

$$\Delta H_s = m_s H_s \quad \text{or} \quad \Delta H_s = m_c H_c$$

From steam tables

$$H_{s,543.1} = 2746.5 \text{ kJ / kg}$$

$$H_{c,155} = 627 \text{ kJ / kg}$$

$$\Lambda = H_s - h_s$$

$$F = L + V$$

$$F x_F = L x_L$$

$$q = U A \Delta T$$

$$q = S(H_s - h_s) = S\Lambda$$

$$q = (H_2 + H_v) - H_1$$

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
2012 ACADEMIC YEAR FIRST SEMESTER 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 the following additives: xanthan, β -carotene, sodium caseinate, sucrose and tocopherol.

- (a) How do you propose to blend the two into one blended drink with its additives (propose a flow-sheet to explain your answer, give reasons for each step in your proposed flow-sheet). **(10 marks)**
- (b) What are the functions of the additives mentioned in this process? **(6 marks)**
- (c) 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? **(7 marks)**
- (d) State and briefly, discuss three important destabilizing factors of your blend **(7 marks)**

Question 2

(a) Write short notes on the following:

- i. Marangoni effect
- ii. HLB value
- iii. Critical micelle concentration
- iv. Spreading coefficient of liquid droplets
- v. Zeta potential

(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) Emulsifiers can be classified in many ways. One of the broad classifications is as given below. Explain how each of these functions as emulsifiers:

(i) Small molecule surfactants

(3 mark)

(ii) Polysaccharides

(3mark)

(iii) Proteins

(4 marks)

Question 4

a. 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-class **(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 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 **(20 marks)**

Question 6

(a) The rheological behavior of liquids can be defined by an empirical power law model

$$\tau = C^* (\dot{\gamma})^n$$

Where τ = stress, C = consistency index, $\dot{\gamma}$ = strain and, n = the flow behaviour index. Describe the classification of liquids for the flow behavior index n when $n=1$, $n>1$ and $n<1$ **(14 marks)**

(b) What are viscoelastic materials? In your definition, give an example **(6 marks)**

Question 7

(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 ($\delta=925 \text{ kg/m}^3$) as well as 1.2 g of purified egg lecithin ($\delta=1050 \text{ kg/m}^3$) 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 potential gradient of 20V/cm was applied across 0.2 mol/dm^3 NaCl aqueous solution. A spherical particle of $1.0\mu\text{m}$ 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 $140\mu\text{m}$ 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) the electrophoretic mobility of the particle **(3 marks)**

(ii) the zeta-potential of the particle **(7 marks)**

End of Exam (FORMULAE AND CONSTANTS OVERLEAF)

Formulae and constants for examination

$$\Gamma = -1/(R^*T) * (d\gamma / d\ln C) = -C / R^*T * d\gamma / dC$$

$$\Gamma = -(1/(z^+ + z^-)) * 1/(R^*T) * (d\gamma / d\ln C) = -(1/(z^+ + z^-)) * C/(R^*T) * (d\gamma / dC)$$

$$\Sigma = 1 / \Gamma$$

$$Pa_1 = (1/\Gamma) / N_A = \Sigma / N_A$$

$$\Delta P_L = 2 \gamma / r = -2 * \gamma * \cos \theta / r_c = h * \delta * g$$

$$(2 * \pi * r_c) * \gamma * \cos \theta = (\pi * r_c^2 * h) * \delta * g$$

$$\mu = \frac{\zeta * \epsilon}{1.5\eta} \quad \text{Debye - Hückel equation}$$

$$\mu = \frac{\zeta * \epsilon}{\eta} \quad \text{Helmoltz-Smoluchowski equation}$$

$$\mu = \frac{V}{E}$$

$$\kappa = \sqrt{(2 * Z^2 * F^2 * C_o / \epsilon RT)}$$

$$\kappa = \sqrt{(2 * Z^2 * e^2 * n_o / \epsilon kT)}$$

$$\kappa = 1.04 * 10^8 \sqrt{(C_o * Z^2)}$$

$$R^*T \ln [P_{vr}/P_{vo}] = 2 * \gamma * M / \delta * r = 2 * \gamma * V_L / r$$

$$t_{1/2, \text{slow}} = W * t_{1/2, \text{fast}}$$

$$t_{1/2, \text{rapid}} = 3 * \eta / (4 * k * T * N_o) = 2 * 10^{17} / N_o \text{ at } 25^\circ\text{C in water}$$

$$N_o = fv / [(\pi/6) * \phi^3]$$

$$F = 96485 \text{ C / Mole}$$

$$e = 1.602 * 10^{-19} \text{ C}$$

$$R = 8.314 \text{ J / (mole.K)}$$

$$\epsilon_o = 8.85 * 10^{-12} \text{ F/m}$$

$$k = 1.38 * 10^{-23} \text{ J/K}$$

$$N_A = 6.023 * 10^{23}$$

$$\delta_{\text{H}_2\text{O}} \text{ at } 22^\circ\text{C} \approx 1000 \text{ kg/m}^3$$

$$g = 9.81 \text{ m/s}^2$$

$$\pi = 3.14$$

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2012/2013 ACADEMIC YEAR
FIRST SEMESTER FINAL EXAMINATIONS

AGF 531: TECHNOLOGY OF PLANT PRODUCTS I
TIME: THREE (3) HOURS

INSTRUCTIONS:

ANSWER ALL QUESTIONS.

Question 1

Explain the following terms (Maximum 5 lines) where possible with diagrams;

- i. Gluten
- ii. Compound Imbibition
- iii. Touching angle (in rollers)
- iv. Cyanogenic glucosides (in Cassava)
- v. Semolina
- vi. Dextrose equivalent value
- vii. Acid liquafaction
- viii. Staling (in bread)
- ix. Degree of supersaturation (in cane sugar processing)
- x. Brabender Farinogram

(20 Points).

Question 2

The purification stage in the processing of sugar cane is an important step.

- (i) Describe the aims of the purification process.
- (ii) Give and explain the three process of juice purification, stating the corresponding reactions involved in each process.

(20 Points).

Question 3

Enzymatic browning of sweet potatoes is a big challenge during processing.

- (i) Explain how the browning occurs
- (ii) Give and explain the methods to minimize the browning.

(10 Points).

Question 4

Corn snacks and Corn flakes are emerging as important food products on the Zambian market. For either corn snacks (Jiggies) or Corn Flakes, describe in detail the technology behind their manufacturing.

(10 Points).

Question 5

A local milling company specializing in milling of maize is diversifying into the Wet Milling of Maize. One niche product they are targeting is sorbitol. You have been engaged as a consultant to show to the top management on how they can go about to obtain sorbitol from Maize.

Describe in detail how they can obtain this product from maize. (Show the process flow diagrams where appropriate).

(40 Points).

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY
2012/13 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION
AGF 541 – Technology of Dairy and Egg Products

Instructions:

Answer **all** questions;

All questions carry equal marks.

Time allowed: Three (3) Hours

1. UHT milk is an important dairy product with a long shelf-life.
 - a. Explain and illustrate the manufacturing process of UHT milk. **[15 marks]**
 - b. Discuss the difference between steam injection and steam infusion. **[6 marks]**
 - c. Rank the nutritional quality of UHT milk according to the different processing methods. **[2 marks]**
 - d. Compare the shelf-life of pasteurized, UHT and sterilized milk. **[2marks]**

2. Chibala-Mwanza Dairy Products is involved in the manufacture of flavoured set yoghurt. The company technical manager approaches you with a problem of water separation in the product after two days of manufacturing. Explain:
 - a. The principle of this phenomenon. **[2 marks]**
 - b. the possible causes highlighting the different tests and checks you would carry out on the product and production line. **[8marks]**
 - c. the possible solutions and make recommendations that will prevent the problem from recurring. **[7 marks]**
 - d. the changes that should be made to the existing line if the company wishes produce set and stirred fruit yoghurt. **[8 marks]**

3.

- a. Explain the importance of heat treatment in yoghurt and soft cheese manufacturing and give their respective temperature-time combinations. **[8 marks]**
- b. Discuss the functions of starter cultures. **[8 marks]**
- c. Describe the churning process in butter making. **[6 marks]**
- d. Discuss the freezing stage in ice-cream making. **[3 marks]**

4. Using a flow diagram, show the manufacturing process of ice-cream, fresh cream and soft cheese. **[25 marks]**

Good luck and God bless!

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012 SEMESTER I FINAL EXAMINATIONS
AGF 2011 FUNDAMENTALS OF ORGANIC CHEMISTRY

TIME: THREE(3) HOURS

INSTRUCTIONS

- 1 There are **five** questions in this Examination Paper.
 - 2 Answer any **FOUR** questions.
 - 3 Each question carries 25 marks.
-

Question 1

- (a) (i) With a suitable example explain the difference between a chiral carbon and achiral carbon.
- (ii) Draw structural formulas for the four isomeric chloropropenes (C_3H_5Cl)
- (b) Give the structure and name of the alkene that yields on ozonolysis $CH_3CH_2CH=O$ and $CH_3CH=O$
- (c) There are three isomeric alkanes of molecular formula C_5H_{12} . Isomer **A** gives a mixture of four monochlorination products when reacted with chlorine gas at $300^\circ C$. Under the same conditions, isomer **B** gives a mixture of three monochlorination products while isomer **C** gives only one monochlorination product. From this information assign structural formulas to isomer **A**, **B** and **C**.
- (d) Draw all the structural isomers of C_4H_8 . How many are:
- (i) alkanes and
 - (ii) alkenes

Question 2

- (a) You are given a liquid that could be either cyclohexane or cyclohexene. What simple test could you perform to tell which it is? Describe exactly what you would do and what you would see in each case.
- (b) There are four isomeric alcohols of molecular formula $C_4H_{10}O$. Draw and name each isomer. One of the four isomeric alcohols compound **D** ($C_4H_{10}O$), on oxidation by $K_2Cr_2O_7$ in acid solution gives compound **E** ($C_4H_8O_2$), a carboxylic acid. Treatment of compound **D** with warm phosphoric acid brings about dehydration and yields compound **F** (C_4H_8). Treatment of compound **F** with warm aqueous sulphuric acid gives compound **G** ($C_4H_{10}O$); a new alcohol isomeric with compound **D**, compound **G** is resistant to oxidation. Propose structures for compounds **D**, **E**, **F** and **G** consistent with these observations.
- 6

- (c) Draw all the structural isomers of formula $C_4H_{10}O$. How many are alcohols?
- (d) Show clearly how you would convert ethane to n-butanol

Question 3

- (a) Name and draw structural formulas for the five isomeric alcohols of molecular formula $C_5H_{12}O$. Classify each as primary, secondary or tertiary. Which of the ~~eight~~ *five* alcohols show enantiomerism?
- (b) Draw structural formulas for all compounds of molecular formula C_5H_{10} that are:
 - (i) Alkenes that do not show cis-trans isomerism
 - (ii) Cycloalkanes that do show cis-trans isomerism
- (c) Show clearly how you would carry out the following chemical transformation using the appropriate reagents by way of chemical equations:
 - (i) Butanoic acid to propane
 - (ii) Propanoic acid to propane
- (d) Work out all the possible structural isomers of pentene C_5H_{10} and hexane C_6H_{12} . How many exhibit geometrical isomerism?

Question 4

- (a) Draw structural formulas for all compounds of molecular formula C_5H_{10} that are:
 - (i) Alkenes that do show cis-trans isomerism
 - (ii) Cycloalkanes that do not show cis-trans isomerism
- (b) Upon heating with dilute sulphuric acid, a compound **D**, $C_{10}H_{18}O$, gave a mixture of two isomeric alkenes, **E** (minor) and **F** (major), of the molecular formulae $C_{10}H_{16}$. The major alkene **F**, gave only cyclopentanone after ozone treatment followed by reduction with zinc and acetic acid. Identify the compounds **D**, **E** and **F**. Show and justify your reasoning.
- (c) An organic compound **X** has the formula C_3H_6O
 - (i) Write four structural formulae for the compound.
 - (ii) Classify each according to its functional group.
 - (iii) Give the systematic IUPAC names for each compound.
- (d) How many structural isomers of butanol, C_4H_9OH , are optically active?

Question 5

- (a) Give the stereo chemical structure (s) of the product (s) that would be obtained when 2-butyne is hydrogenated in the presence of Lindlar's catalyst and Na/NH_3 .
- (b) Compound A ($\text{C}_5\text{H}_{10}\text{O}$) is optically active, decolourizes a solution of bromine in carbon tetrachloride, and also decolourizes dilute potassium permanganate. Treatment of A with hydrogen gas over a platinum catalyst yields a compound B ($\text{C}_5\text{H}_{12}\text{O}$). Treatment of B with phosphoric acid forms a compound C (C_5H_{10}). Ozonolysis of C yields two compounds, CH_3CHO and $\text{CH}_3\text{CH}_2\text{CHO}$, in equal amounts. Only compound A is optically active. Propose structural formulas for compounds A, B and C consistent with these observations.
- (c) Starting with bromoethane, explain with equations how you would make methylpropanoate and ethyl propanoate.
- (d) Which of the following can exist as enantiomers?
- (i) 2-bromopropane
 - (ii) 2-bromobutane
 - (iii) 2-bromopentane
 - (iv) 3-bromopentane
 - (v) $\text{CH}_3\text{CH}(\text{OH})\text{C}_2\text{H}_5$
 - (vi) $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST SEMESTER EXAMINATION FEBRUARY/MARCH 2013
NUTRITION/FOOD SCIENCE & TECHNOLOGY GENERAL MICROBIOLOGY (AGF 2401)

INSTRUCTIONS:

1. Answer all the questions.
 2. Use **different Answer Booklets** for **each section**.
 3. The **marks** are indicated **in parenthesis**.
-
-

SECTION I: BACTERIOLOGY

- Q1.** Write brief notes on **any four (4)** of the following:
- a. Bacteriostatic and Bacteriocidal antibiotics **(5 marks)**
 - b. Main methods of sterilization **(5 marks)**
 - c. Gram positive and negative bacteria staining principle **(5 marks)**
 - d. Processes of Bacteria genetic material exchange **(5 marks)**
 - e. Importance of microorganisms in the food processing industry **(5 marks)**
 - f. Simple and differential staining techniques **(5 marks)**
- Q2.** Bacteria are living organisms that are microscopic and usually unicellular in nature. Describe bacterial reproduction and growth in a liquid medium **(20 marks)**.

SECTION II: VIROLOGY

- Q3.** Describe the growth of viruses. In your answer, you should explain the stages of viral replication and also describe the **“One Step growth experiment”**. **(20 marks)**
- Q4.** What is meant by the term **“mutation”**? In your answer, you should describe three examples of mutations that are important in virology. **(20 marks)**

PLEASE TURN OVER

SECTION III: MYCOLOGY

Q5. Using examples, compare and contrast the following:

- a) Deuteromycota *versus* Ascomycota **(10 marks)**
- b) *Aspergillus flavus* *versus* *Aspergillus fumigatus* **(10 marks)**

Q6. Write brief and informative notes on any four (4) of the following:

- a) Yeasts **(5 marks)**
- b) Arthrospores **(5 marks)**
- c) Anti-fungal drugs **(5 marks)**
- d) Lactophenol Cotton Blue mounting Solution **(5 marks)**
- e) Prevention of fungal infections in humans **(5 marks)**
- f) Zygosporangia **(5 marks)**

END OF EXAMINATION!

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

AGF 3021: CHEMICAL TECHNIQUES IN FOOD ANALYSIS

TIME : 3 HOURS

EXAMINATION- FEBRUARY 2013

ANSWER : ANSWER ANY FIVE QUESTIONS.

: ALL QUESTIONS HAVE EQUAL MARKS.

WHERE APPLICABLE, ALL CALCULATIONS ARE TO BE DONE CORRECTLY TO THREE DECIMAL PLACES. BALANCE ALL CHEMICAL EQUATIONS.

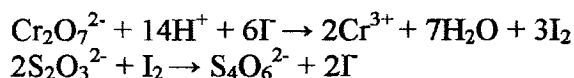
QUESTION 1

- a) Consider the case when you want to compare the result of your experiment with some known and accepted value. How can you calculate the percent deviation from the reference value?
- b) Explain in detail the mechanism of operation of the following terms and give two examples for each.
 - I. Qualitative Analysis.
 - II. Quantitative Analysis
- c) A lot of laboratory and even industrial fields need frequent instrument calibration. Give an example and state the Characteristics of Calibration and the range.
- d) Given that 0.08g of impure chalk was reacted with 100cm³ of 1 mol dm⁻³ HCl (an excess). The mixture was filtered into a volumetric flask and made up to 250cm³. A 25.0 cm³ portion of the solution required 8.5cm³ of 1 mol dm⁻³ NaOH solution for neutralization. What is the percentage of CaCO₃ in the impure chalk?

QUESTION 2

- a) With the help of a simple sketch Explain briefly the mechanism of operation for the following Automatic Sampling systems
 - I. Rotary Cross-Cut Sampler
 - II. Pneumatic Line Sampler.
 - III. Belt End Samplers.

- b) What is meant by Sampling, Particle size and Sample reduction
- c) A student took a calibrated 200.0 gram mass, weighed it on a laboratory balance, and found that it read 196.5 g. and another student measured the specific heat of water to be 4.29 J/g · Cal. The literature value of the specific heat of water is 4.18 J/g · Cal. Which of the two students had a big percent of deviation?
- d) 25.0 cm³ of potassium dichromate (VI) solution were acidified and treated with excess KI (aq). The liberated iodine was titrated with 24.4 cm³ of 0.102 mol dm⁻³ Na₂S₂O₃ (aq). Calculate the concentration of the K₂Cr₂O₇ (aq).



QUESTION 3

- a) What is Co precipitation? List the different types of Co precipitation, and indicate how they may be minimized.
- b) Explain the following terms and state why they are necessary?
 - I. Precipitation.
 - II. Digestion.
 - III. Filtration.
 - IV. Washing.
- c) What are the factors that determine the particle size of precipitates and what is the Von Weimar ratio? Define each term in relation with the Experimental control of particle size.
- d) The Ca in a 200.0 cm³ sample of natural water was determined by precipitating the cation as CaC₂O₄. The ppt was filtered, washed and ignited in a crucible with an empty mass of 26.7134g. The mass of the crucible plus CaO (56.077g/mol) was 26.7134g. Calculate the concentration of Ca (40.078 g/mol) in the water in units of grams per 100 cm³.

QUESTION 4

- a) Sketch three pH curves, one for the titration of the Weak Acid - Strong Base, one for a Strong Acid – Strong Base and one for Strong acid – Weak Base. List the major species at the equivalent point for each curve and list the reactions in general that you expect (do not give specific examples and **3 graphs only**).
- b)
 - I. Distinguish between a primary standard and a secondary Standard.
 - II. What are the requirements for the Primary standards?
 - III. List four desirable properties of a standard solution.

c) Define the following terms.

- I. Equivalent point.
- II. End point. Describe the way in which the end points of Redox Titrations may be detected visually.
- III. Titration error.

d) An impure sample of barium hydroxide - $\text{Ba}(\text{OH})_2$ of mass 1.6524g was allowed to react with 100 cm^3 of 0.2M HCl. When the excess acid was titrated with NaOH, 10.9 cm^3 of Sodium hydroxide solution was required. 25.0 cm^3 of NaOH required 28.5 cm^3 of the HCl in a separate titration. Calculate the percentage of purity of barium Hydroxide.

QUESTION 5

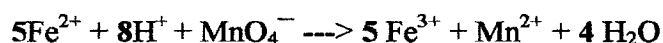
a) Depending on the material and the demands placed on the sieving result, various sieving methods are used for determining particle size and distribution. A basic differentiation is made between these methods: Describe the following basic methods and explain briefly how each method is used to determine the percentage of undersize and oversize particles.

- I. Single Sieve and Sieve set sieving.
- II. Dry and wet Sieving.

b) Explain briefly what is meant by Evaluation of the Sieving Process and how is it determined?

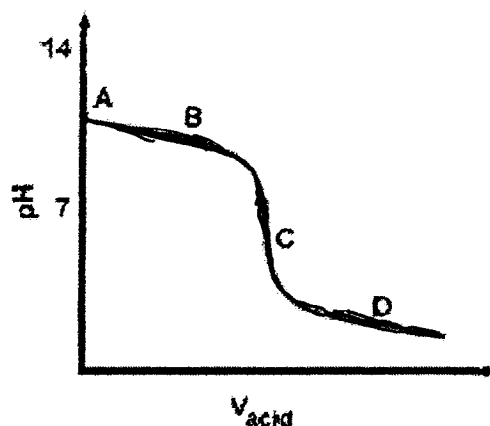
c) How can an optimal sieve analysis be carried out? Explain briefly the three principle precondition that may be carried out.

d) A solution contains both Iron (II) and Iron (III) ions. A 50.0 cm^3 sample of the solution is titrated with 35.0 cm^3 of 0.00280 M KMnO_4 , which oxidizes Fe^{2+} to Fe^{3+} . The permanganate ion is reduced to manganese (II) ion. Another 50.0 cm^3 sample of solution is treated with zinc metal, which reduces all the Fe^{3+} to Fe^{2+} . The resulting solution is again titrated with 0.00280 M KMnO_4 , this time 48.0 cm^3 is required. What are the concentrations of Fe^{2+} and Fe^{3+} in the solution?



QUESTION 6

- a) Write a description of the general steps for the titration procedure to determine the molarity of a solution of a substance.
- b) List the major species at points A, B, C, and D on the following titration curve of the titration of Ammonia with HCl.



- c) Write a description of how phenolphthalein is able to show when the endpoint is reached in the titration of an acid with a base.
- d) Given the following data in a titration reaction of 25.0 cm³ of 0.125M NaOH and 0.0625 M HCl.

NaOH(V)	0.0	5.0	10.0	15.0	20.0	22.0	24.0	25.0
pH	1	1.14	1.30	1.51	1.85	2.08	2.57	7.00
HCl (n)								

- I. Copy and complete the table by calculating the number of moles of HCl present at the given points.
- II. Calculate the Volume of HCl required to completely neutralizing the NaOH.
- III. Calculate the pH of the solution at the beginning of the experiment.
- IV. Which would be a suitable indicator to use in this experiment and why? What color changes would you observe at the start and end of the experiment.

Wish you well, The End

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

AGF 3021: CHEMICAL TECHNIQUES IN FOOD ANALYSIS

TIME : 3 HOURS

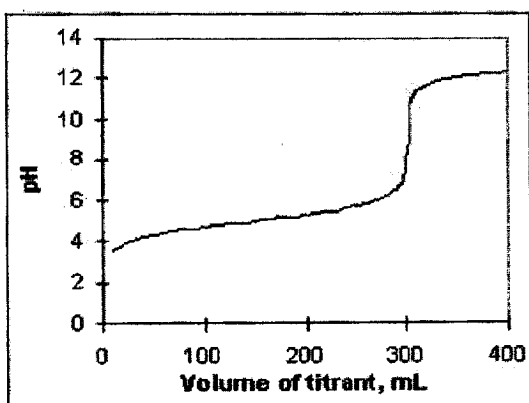
PRACTICAL EXAMINATION - 27th FEBRUARY 2013

ANSWER : ANSWER ALL QUESTIONS.

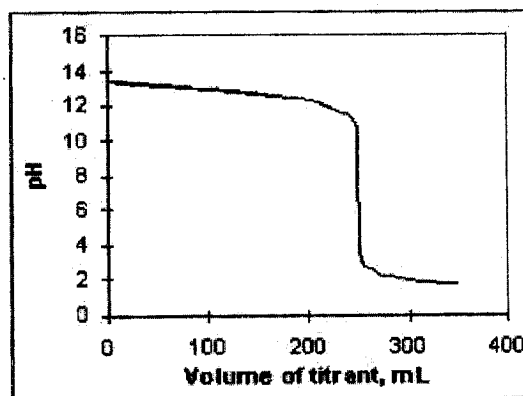
WHERE APPLICABLE, ALL CALCULATIONS ARE TO BE DONE CORRECT TO THREE DECIMAL PLACES. BALANCE ALL CHEMICAL EQUATIONS.

QUESTION 1

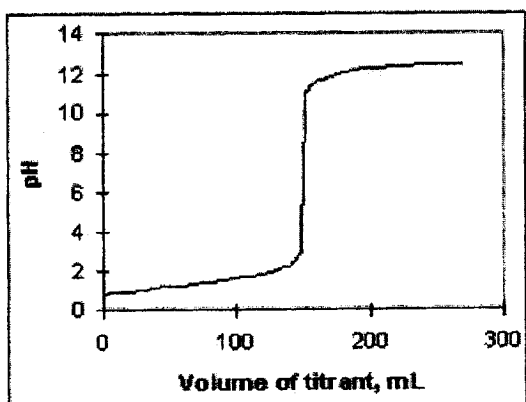
Titration (a)



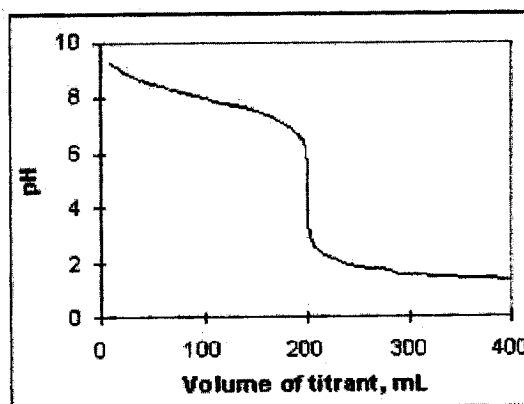
Titration (b)



Titration (c)



Titration (d)



- Which one of the titration curves corresponds to the titration of a weak acid (in flask) with a strong base (in buret)?
- Consider titration (b). What was the original concentration of the acid or base in the flask if the original volume was 100 cm^3 and it was titrated with a standard solution (in buret) that had a concentration of 0.100 M ?
- Analyze each curve and give a brief explanation of its shape.

(10marks)

QUESTION 2

Consider the following titration for 20.0 cm^3 of 0.060 M HClO_4 (in the flask) is titrated with 0.040 M NaOH (in buret).

- What is the overall reaction occurring in the titration? How many cm^3 of the NaOH solution need to be added to reach the equivalence point of the titration?
- What would be present in the flask after some NaOH has been added, but before the equivalence point has been reached?
- What would be present in the flask at the equivalence point and calculate pH of the solution in the flask at the equivalence point of the titration?

(10marks)

QUESTION 3

Natural bottled water is very popular and numerous companies contribute a variety of products. Due to a wide variation of concentration levels of Ca^{2+} and Mg^{2+} from product to product. A Client would like you to carry out an analysis to determine the concentration of Ca^{2+} and Mg^{2+} present in a particular product.

Part A: Determination of total hardness

- Provided for you is a water sample labeled P1
- Provided is a buffer solution followed and Eriochrome Black T indicator.
- Provided a 0.01 M EDTA solution.

Repeat the titration to obtain three concordant results.

Part B: Determination of concentration of $\text{Ca}^{2+}(\text{aq})$ ions

In the sample provided in part A determine of concentration of $\text{Ca}^{2+}(\text{aq})$ ions

- Provided for you is Murexide powder as indicator and NaOH solution, swirl the solution and wait for a couple of minutes to completely precipitate the magnesium ions as $\text{Mg}(\text{OH})_2(\text{s})$.

2. Provided is a 0.01 M EDTA solution until the expected colour changes.

Repeat the titration to obtain two concordant results.

Calculate and write a full report for your client.

1. Determine the total concentration of $\text{Ca}^{2+}(\text{aq})$ and $\text{Mg}^{2+}(\text{aq})$ ions in the mineral water sample in **mg/L (ppm)**.
2. Determine the concentration of $\text{Ca}^{2+}(\text{aq})$ ions in the mineral water sample in **mg/L (ppm)**. Hence calculate the concentration of $\text{Mg}^{2+}(\text{aq})$ ions in the mineral water sample.

(30marks)

Wish you well, thank you.

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012 ACADEMIC YEAR FIRST SEMESTER
FINAL EXAMINATIONS
AGG3911: RURAL SOCIOLOGY

TIME : THREE (3) HOURS
TOTAL MARKS : 100
DATE OF EXAMINATION : 21/03/2013
INSTRUCTIONS : ANSWER ALL QUESTIONS IN SECTION A AND B

SECTION: A

(SHORT ANSWERS. ANSWER ALL. TOTAL MARKS 40)

- 1) Fully explain the emphasis of the three most influential theoretical approaches used to explain social inequality that is a subject of debate in Sociology (*9 marks*).
- 2) State the reasons why Weber's bureaucratic organization has assumed a superior form compared to other known organizations (*3 marks*).
- 3) Explain your understanding of an open integrated type of community and how this differs from a closed disintegrated community (*4 marks*).
- 4) Identify and analyze the factor that qualifies Sociology as a science and discuss how it is a close relation of social anthropology and economics (*6 marks*).



The University of Zambia

School of Agricultural Sciences

FIRST SEMISTER EXAMINATION- ACADEMIC YEAR 2011

Course: AGG 6121- Agroclimatology and Crop Physiology

Time: Three (3) Hours
Answer ALL.

Answer: all Questions

Section A

1. Contrast Leibig and Mitscherlich's type of limitations in breeding for stress adaptation. [15 marks]
2. Discuss physiological strategies for increasing yield. [10 marks]
3. What is the Net Assimilation ratio and what factors determine this parameter [10 marks]
4. What is leghaemoglobin and what role does it play in rhizobia. [5 marks]

Section B

5. Briefly define each of the following terms [15 marks]
 - a) Dewpoint temperature [3 marks]
 - b) Solar constant [3 marks]
 - c) Threshold temperature for plant growth [3 marks]
 - d) Growing degree day [3 marks]
 - e) Tropopause [3 marks]
6. All domestic animals have local and integrated mechanisms to ensure that the temperature of the body is maintained at constant ideal levels. [10 marks]
 - a) With the aid of a diagram, show the temperature dependent zone of survival for living organisms

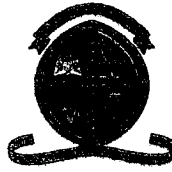
- b) What mechanisms have some organisms developed to regulate and compensate temperature changes
7. The depletion of the solar energy and associated processes in the earth's atmosphere results in a temperature profile around the earth: [10 marks]
- a) What are the three distinct and very important sources of heat energy typical of the earth's atmosphere;
- b) There has been significant level of consensus amongst scientists on climate change and that there has been temperature trends on Earth according to IPCC (2001), briefly outline these trends
8. Given the following meteorological data measured on October 22, 2011 at UNZA Farm in Chongwe (28.47° E, 15.396° S and altitude 1162 m): [25 marks]

Tmax	31.9°C
Tmin	20.2°C
Tdew	13.0°C
Solar radiation (Rs)	24.00 MJ m ⁻²
Estimated extra-terrestrial radiation (Ra)	30.93 MJ m ⁻²

Determine:

- a) Mean saturation vapour *in kPa*
- b) Actual saturation vapour pressure *in kPa*
- c) Relative humidity (%)
- d) Declination angle in radians
- e) Sunset hour angle in radians
- f) Sunshine hours
- g) Solar radiation on a (i) clear sky and (ii) overcast day (MJ m⁻² d⁻¹)

END OF EXAMINATION



UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATIONS-MAY, 2012

AGG 6132: SOIL PLANT WATER RELATIONS

Time:	Three (3) Hours	Total Marks: 100
Instruction:	Answer all Questions <i>Non-programmable calculators are allowed</i>	

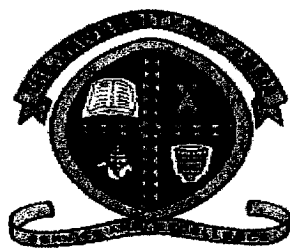
1. Briefly define each of the following terms (15 marks)
 - a) Aeration porosity
 - b) Harvest Index
 - c) Field capacity
 - d) Hydraulic conductivity
 - e) Available water-holding capacity
2. With the aid of a diagram briefly describe four most important points on the soil water retention curve. (15 marks)
3. Describe the TDR method used in determining soil moisture content. In your discussion include (i) the theoretical principles upon which it is based, (ii) how the calibration is handled, and (iii) its advantages and disadvantages. (15 marks)
4. AquaCrop simulates the biomass and yield in response to water which is increasingly becoming one of the critical factors limiting crop production in Zambia. Describe the major calculation scheme of the AquaCrop model in simulating attainable yield of a fully irrigated crop. (15 marks)
5. The Maximum yield is determined by both genetic and environmental conditions, and can be determined using the Wageningen or agro-ecological zone methods. (20 marks)
 - a) What are the major differences between the two methods?
 - b) Why is it important to correct for net dry matter production when using the agro-ecological zone method?

- c) Given the following data, Maximum actual incoming short wave radiation (R_{se}) = 299 cal/cm²/day, Gross dry matter production on a clear day (y_c) = 376 kg/ha/day, Gross dry matter production on an overcast day (y_o) = 197 kg/ha/day, ET_m = 6.0 mm/day, Vapour pressure deficit = 7 mbar, Measured sunshine duration (n) = 6 hr/day, Maximum sunshine hours (N) = 13 hrs/day, R_a = 925 cal/cm²/day.

Given a wheat crop growing for 123 days with $K = 1.2$, $c_H = 0.35$ and $c_T = 0.6$ at an average temperature of 20°C, and the information above, calculate the following:

- i. The actual measured incoming radiation (R_s)
 - ii. The fraction of the daytime the sky is clouded (F)
 - iii. Gross dry matter production of a standard crop (Y_o)
 - iv. The maximum expected yield (Y_{me})
6. A layered vertical soil column consists of a loamy textured layer ($K_2 = 0.2$ cm h⁻¹, $L_2 = 50$ cm) with another soil layer of equal length over it. Given that the effective saturated conductivity of the layered vertical soil column is 0.003 cm day⁻¹ and the top of the column has water ponded at a constant height of 10 cm above it and the bottom is open to the atmosphere: (20 marks)
- a) Calculate the flux in (i) mm/day and (ii) m³/day/ha
 - b) Given that the cross section area of the soil column is 0.01 m², Calculate the specific discharge rate (Q) in m³/day
 - c) Calculate the hydrostatic pressure distribution in the column (in cm)
 - d) Calculate the hydraulic conductivity of the surface layer (in mm/day)

End of Exam



UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
PLANT SCIENCE DEPARTMENT
UNIVERSITY EXAMINATIONS

AGG 6211 BIostatISTICS

NOVEMBER 2011

INSTRUCTIONS

Answer Question No. 1 and any other THREE. Points for each question are indicated in brackets.

TIME: 3 hours

Q.1 (a). As a new recruited plant breeder in a new agricultural research institution you are to give a seminar on use of factorial experiments in scientific investigation. You have the following data from an experiment on animal nutrition for your presentation. The response variable is the thickness of back fat averaged over 6 pigs over a period of 14 weeks. Prepare a comprehensive presentation.

Mineral rate	Vitamin rate (mg/kg)	Block		
		I	II	III
Low (L)	1.5	4.20	4.94	4.45
	2.0	4.36	3.50	4.17
	2.5	5.40	4.55	5.75
	3.0	5.15	4.40	3.90
High (H)	1.5	2.82	3.14	3.80
	2.0	3.74	4.43	2.92
	2.5	4.82	3.90	4.50
	3.0	4.57	5.32	4.35

(25 points)

Q.1 (b). You are given information/data on drought occurrence in the last two centuries as follows:

	Drought	No Drought
1801-1909	4	45
1910-2010	14	42

The question poised is, 'are the summers of the current century significantly more prone to drought than the previous one?' Establish the basis of responding to this question substantively **(15 points)**

Q.2 Write short notes on the following: **(4 points each)**

- Importance of clear definition of a problem in research and use of Problem Tree Analysis
- Randomization for the Latin Square Design.
- Sampling methods discussed in the course
- Formats of Research Proposal and Research Report.
- Derivation of totals for interactions for Split-Split-Plot Design for the three way interactions; Illustrate.

Q. 3 Given the following data from a factorial experiment on survival (%) of a bacteria (*Salmonella typhimurium*), test if the effect of sorbic acid on survival of the bacteria under the four regimes of water temperature is linear. The experiment was carried with 3 replications. **(20 points)**.

	Water Temperature (°F)			
Sorbic acid concentration (ppm)	98	94	90	86
0	24.89	19.60	17.99	15.42
100	23.02	19.22	16.07	14.09

The table below is to be used for the testing of linearity. Assume equal spaced treatments. Use the coefficients provided for n=4.

Mean Squares for use in testing significance of responses to water temperatures.

Source	df	MS
Sorbic acid (SA)	1	1.155
WaterT Linear (WTL)	1	a**
WaterT NonLinear (WTNL)	1	b**
SA x WTL	1	c**
SA x WTNL	1	d**
Error	9	0.024
** These values you have to be calculated		

Q. 4 In a study on productivity of potato the following data were obtained.

Fertilizer amount (NO_3 kg/ha)	Yield (tons/ha)
0	18.34
100	19.56
200	20.15
300	20.99

(20 points)

Answer the following questions about these data:

- How is yield of potato influenced by fertilizer?
- Is the effect of nitrogen fertilizer on yield of potato linear?
- How reliable is the relationship between these variables?

Q.5 List the assumptions that must hold for Analysis of Variance to be used **(8 points)**. For two of these illustrate how you would test for their validity. **(12 points)**

END OF EXAMINATION

**UNIVERSITY OF ZAMBIA
SECOND SEMESTER-EXAMINATIONS**

7 June 2012

AGS222

FUNDAMENTALS OF SOIL SCIENCE (II)

DURATION: 3 HOURS

INSTRUCTIONS: Answer all Questions

MARKS: 100

- 1 Indicate whether the following statements are true or false. (20 marks , 2 marks each)
- a) The aluminium saturation of a sodic soil cannot be 87 %.
 - b) Manganese is a secondary nutrient
 - c) Portlandite (Ca(OH)_2) has a higher Neutralizing value than Calcite (CaCO_3).
 - d) A soil with 2 mm $\text{H}_2\text{O}/\text{cm}$ soil contains more water than a soil with a bulk density of 1.4 g.cm^{-3} that has $10 \text{ gH}_2\text{O}/100 \text{ g soil}$.
 - e) The CEC of soils generally decreases with increasing soil pH.
 - f) Plants will wilt permanently when the diameter of the largest pores filled with water in the soil in which they are growing is $1.9 \mu\text{m}$.
 - g) In the mineral SiO_2 , the silicon ion Si^{4+} is larger than the oxygen ion O^{2-} .
 - h) The osmotic potential of a soil decreases with increasing temperature.
 - i) Seven of the 16 essential elements for plants are micronutrients.
 - j) More energy is required to extract 1 kg of water from a soil at permanent wilting point (at -15 bar matric potential) than to extract 1 kg of pure water from a salty solution of 0.2 molal NaCl at 22°C .

Some Useful data: $R = 8.3145$, Atomic masses: Ca = 20 g, Na=23 g, Cl=34.5g, O=16g, H=1g, C=12 g.

- 2 Define the following terms: (Total 15 marks or 1.5 marks each)
- a. Straight fertilizer
 - b. Matric potential
 - c. Reserve Acidity
 - d. Macronutrient
 - e. Variable Charge
 - f. Water Holding capacity of a Soil
 - g. Coordination number of a cation in a crystal structure.
 - h. Effective Cation Exchange Capacity

- i. Diffuse Double layer of a soil colloid.
- j. Exchangeable sodium percentage

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

- a) List the 13 essential elements required by plants that are normally obtained from the soil, and indicate: (i) their classification according to plant nutrition, (ii) their classification in the fertilizer industry and (iii) their bio-available form for uptake by plants (10 marks)
- b) A vegetable farmer in Mporokoso wants to grow cabbage on a field that was previously used to grow Egg Plants. To fertilize the field she uses crop residues and ammonium nitrate fertilizer.
 - i.) What would be the 3 potential causes of soil acidity on this field? (3 marks)
 - ii.) If the pH of the soil is 4.8, what effect will this have on the growth of cabbage? (3 marks)
 - iii.) Suggest one method you would recommend to correct the acidity in the soil and write a balanced equation or equations showing how your suggested method would neutralize the acidity in the soil. (4 marks)

4 Tensiometers are instruments used to measure the matric potential of moist soils. A tomato farmer installed tensiometers at three different depths in the field to monitor the matric potential in the soil. Below are the suction readings of the three tensiometers.

<u>Horizon</u>	<u>soil depth (cm)</u>	<u>Tensiometer reading (suction in cm)</u>
A	30	560
B	60	680
C	90	630

Based on the information above answer the following: (20 marks)

- a) Are any of the three soil horizons in this field saturated with water? Give reasons to support your answer. (2 marks)
- b) If the osmotic potential is negligible in this profile, calculate the Hydraulic head ($H = \psi_m + \psi_g$) for each of the horizons and express the answer in bars. Use the soil surface as the reference level. (6 marks)
- c) In which direction will water flow between Horizons A and B? Give reasons to support your answer. (3 marks)
- d) What is the diameter of the largest pores filled with water in Horizon B? Show calculations to support your answer (4 marks)

- e) The equation relating the gravimetric moisture content of the soil to the pF of the soil in horizon A is:

$$\Theta_g = 10^{[(pF + 0.52)/(-3.4)]},$$

where: Θ_g is in gH₂O/g soil, and pF = log₁₀ (suction of the soil in cm).

If the bulk density of the horizon is 1.4 g.cm⁻³ calculate the volume of plant available water in litres present in one hectare of Horizon A. **(5 marks)**

(Note: the pF at permanent wilting point is 4.18).

- 5 A soil sample from the surface horizon of a prospective horticultural farmer's field in Chibombo District has the following selected physical and chemical properties.

Depth (cm)	ρ_b g.cm ⁻³	Available P mg/kg soil	Ca -----cmol(+)/kg soil ---	Mg	Na	K	Al	H	EC mS/cm	Org C %	CEC _{pH7} meq/100g	Clay %
0 -20	1.5	5.0	0.25	0.15	0.1	0.07	1.5	0.2	0.12	1.25	6.5	18

Based on the data presented in the table above answer the following questions:
(25 marks)

- What is the Effective Cation Exchange Capacity of this soil? **(2.5 marks)**
- Classify this soil in terms of its salinity and sodicity. Give reasons to support your answer. **(2.5 marks)**
- What percentage of the CEC of the soils at pH 7 is due to organic matter?
(2 marks)
- How much agricultural lime with a neutralizing value of 95 % is required per hectare to reduce the Al saturation to 10 % in the soil? **(4.5 marks)**
- If a farmer wants to grow a crop of green pepper that requires 110 kg N/ha, 48 kg P/ha and 180 kg K/ha. Would the above soil be able to supply adequate amounts of P and K for this crop? Show calculations to support your answer.
(4.5 marks)
- Assuming the soil is completely deficient in nitrogen and that the nitrogen requirements are to be met by applying Urea (46:0:0), while the shortfall of P in the soil (if any) is to be supplied by Single Super phosphate (0: 24:0), and any shortfall of K in the soil is to be supplied by Muriate of Potash (0:0:60), calculate the amounts of Urea, Single Super phosphate and Muriate of Potash required to meet the requirements of N, P and K for Green Pepper for a 3 Lima plot. **(9 marks)**

END OF EXAMINATION

“Soil Science is Fun”



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THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST SEMESTER EXAMINATIONS – MARCH 2013

AGS 411
SOIL FERTILITY

TIME: 3 HOURS

Marks: 100

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

1. A good understanding of soil reactions is important for good land management.
 - a. What is a lyotropic series? [1 Mark]
 - b. Give the lyotropic series for most common cations in soils. [2 Marks]
 - c. What is complementary ion effect? [2 Marks]
 - d. Give three (3) characteristics of hydrogen reactions in the soil. [3 Marks]
 - e. Give two (2) examples of types of reactions which are of exceptions to reversibility of cation exchange. [2 Marks]
 - f. What reactions do you expect to take place when water-soluble P is applied to the soil under different conditions? [3 Marks]
2. If a farmer brings three (3) soil samples (A, B and C) to your laboratory for a soil pH test and you obtain the following pH readings in 0.01M CaCl₂: A: 4.3, B: 7.9, and C: 8.6.
 - a. What would be your understanding of the constraints the farmer may encounter on each of these soils? [3 Marks]
 - b. What other laboratory tests would you recommend for the three soil samples to confirm your interpretation and give the reason for recommending the particular test in each case? [6 Marks]
 - c. What type of field tests or physical examinations on soils or associated plants would you suggest to be carried out to further confirm your interpretation in each one of the three cases, once you are in the field? [3 Marks]
3. Fertilizers can be very important where soils are not fertile.
 - a. What are fluid fertilizers? [1 Mark]
 - b. What are the advantages and disadvantages of fluid fertilizers? [3 Marks]
 - c. What is bulk blending of fertilizers? [2 Marks]
 - d. Calculate the amounts of Ammonium nitrate (34% N), Single Superphosphate, (20% P₂O₅) and Potassium Chloride (60% K₂O) needed to prepare one (1) ton of a 6 - 14 - 5 compound fertilizer. [3 Marks]
 - e. How many kilograms of additional filler materials do you need to prepare the compound fertilizer described above? [1 Mark]
 - f. What are the main challenges of using natural organic fertilizers? [2 Marks]

4. CEC is an important characteristic of the soil.

- Briefly describe the determining of the CEC of the soil using the Ammonium Acetate method. **[5 Marks]**
- Below is the data for a profile for a Mufulira soil series at Kateshi Coffee Farm in Kasama. The data was obtained from soil analysis carried out at Mt. Makulu Research Station in 1983.

Profile sample number	Depth	Bd	Org. C	pH	CEC	Exchangeable cations (cmol kg ⁻¹)			
						Ca	Mg	K	Na
	cm	g/cm ³	%	CaCl ₂	cmol kg ⁻¹				
1	0-9	1.25	1.35	5.0	5.86	1.32	1.03	0.27	0.06
2	9-27	1.3	0.46	4.1	3.68	0.10	0.07	0.08	0.05
3	27-67	1.3	0.43	4.2	4.76	0.23	0.12	0.17	0.07
4	67-103	1.4	0.26	4.4	4.60	0.15	0.07	0.38	0.05
5	103-145	1.4		4.4	4.70	0.28	0.35	0.48	0.05
6	145-210	1.4		4.4	4.30	0.12	0.11	0.43	0.05

Use the data above to answer the following questions:

- Calculate the total amounts of Ca, Mg, K, and Na in the top 67 cm of soil in kg per ha . You may want to present the results in table format using the profile sample numbers. **[12 Marks]**
 - Using available data, what do you think is the reason for sample number 1 having a much higher CEC than the rest of the samples? **[4 Marks]**
 - Calcium levels are higher than those for Mg except for soil sample number 5. Is this what you would expect for good nutrition of most crops? Comment on this and give reasons for your answer. **[4 Marks] (4)**
5. Discuss in detail four (4) examples of strategies that may be used in the application of Phosphorous fertilizers to different types of soil and clearly indicate the philosophy in each case and the advantages and disadvantages. **[16 marks]**

6. Paddy rice grows well in some parts of the country and it is possible to increase its production.
- a. How is rice able to grow in flooded conditions when other plants would not?
[2 Marks]
 - b. What type of nitrogen fertilizers are recommended for application to paddy rice and give the reasons? [2 Marks]
 - c. What nutrient would most likely be in toxic levels under flooded conditions? Explain why this would be the case and what you would do to reduce the amounts? [5 Marks]
 - d. Give four (4) anaerobic toxins which are likely to affect plant growth in flooded conditions. [2 Marks]
 - e. What parameter is used to measure the extent of reducing conditions in soil?
[1 Mark]
 - f. The first stage of flooding under paddy rice is anaerobiosis.
 - i. Describe what ~~takes~~^{to} happens the availability of oxygen, availability and transformations of Mn and Fe and the extent of reduction under such conditions [5 Marks]
 - ii. What happens to the nutrients and toxins in the second stage of reduction?
[5 Marks]
-

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST SEMESTER EXAMINATIONS - MARCH 2013

AGS 431
SOIL MINERALOGY

TIME: 3 HOURS

Marks: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. Minerals are grouped into classes based on their chemical composition. The common classes of minerals include halides, sulfates, carbonates, sulfides, oxides, hydroxides and silicates. Answer the following questions: *(15 marks)*
 - a. Name one mineral that belongs to each of the following classes of minerals: halides, sulfates, carbonates, sulfides, oxides, hydroxides and silicates. *(5 marks)*
 - b. In which Agro-ecological region of Zambia would you expect common soil minerals belonging to each of the above mineral classes to occur? *(2.5 marks)*
 - c. Explain the reason for the association between the mineral classes and agro-ecological regions you have indicated in question (c) above. *(2.5 marks)*
 - d. What soil management problems are associated with the presence of the following classes of minerals in soils?
 - i. sulfates and carbonates *(2 marks)*
 - ii. sulfides *(1 mark)*
 - iii. oxides and hydroxides *(2 marks)*
2. Silicates minerals are major constituents of soil. Answer the following questions *(25 marks)*.
 - a. There are six (6) structural groups of silicate minerals. List the six structural groups and give an example of one mineral that belongs to each of these classes. *(5 marks)*
 - b. What are dioctahedral and trioctahedral phyllosilicates? *(4 marks)*
 - c. Describe the environmental conditions that favour the chemical alteration of Augite to different phyllosilicate mineral up to the formation of a 1:1 layer silicate mineral and write the chemical formulas of all minerals involved in these transformations. *(8 marks)*

- d. Draw a schematic diagram of Chlorite indicating the planes in which each of the elements in the structure occurs. (4 marks)
- e. Describe the similarities and differences between Chlorite and Muscovite. (4 marks)
3. Answer the following questions briefly and concisely. (20 marks)
- a) List and define the seven crystal systems. (7 marks).
- b) The minerals $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$; $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4 \cdot 2\text{H}_2\text{O}$; $\text{Na}_{0.2}\text{Ca}_{0.1}(\text{Al}_{1.6}\text{Mg}_{0.4})\text{Si}_4\text{O}_{10}(\text{OH})_2$ and $\text{Al}(\text{OH})_3$ are commonly found in soils. Name these minerals? (4 marks)
- c) Nepheline ($\text{Na}_3\text{K}[\text{Al}_4\text{Si}_4\text{O}_{16}]$) is a common mineral in the sand fraction of soils at Nakambala Sugar Estates in Mazabuka District. If its crystallographic properties are: $a=10.0\text{\AA}$, $c=8.4\text{\AA}$, $\alpha=\beta=90^\circ$, $\gamma=120^\circ$, $n_\epsilon=1.526$, $n_\omega=1.529$. Answer the following questions:
- To which crystal system does nepheline belong? Explain why (2.5 marks)
 - Is nepheline biaxial positive or negative? Explain why (2 marks)
 - What would be the retardation red light with $\lambda=660\text{ nm}$ passing through a $25\mu\text{m}$ thin section of this mineral? Show calculations to support your answer . (2 marks)
 - What is the percentage of potassium in this mineral? (2.5 marks)
- 4 A contractor constructing a government facility is suspected to be using sub-standard crushed stones containing less than the desired percentage of a certain particle size class. Because of your knowledge in mineralogy you are requested to assist the Police with investigations. (20 marks)
- a) If the contractor claims to be using crushed stone containing 60 % of the desired particle size, estimate the number of crushed stones required to establish the percentage of stones of the desired particle size class in the sample from the contractor to within 1 % allowable error at confidence level of 99 %. **Note:** $Z_{0.005}=2.58$. (5 marks)
- b) The contractor is alleged to have been buying crushed stone from Mwala Wanga Quarry, which supplies gravel with the desired specifications, but would later mix it with poor quality gravel from another cheaper source to reduce his costs. A random sample of 600 crushed stones from Mwala Wanga Quarry contained 364 stones of the desired particle size class, while a random sample of 800 crushed stones delivered to the construction site by the contractor contained 425 stones of the desired particle size class. Test the hypothesis that crushed stones delivered by the contractor contain the same proportion of stones of the desired particle size class as crushed stones from Mwala Wanga Quarry and draw your conclusion based on a 99 % level of confidence. **Note:** $Z_{0.005}=2.58$. (7.5 marks)
- c) The crushed stones from Mwala Wanga Quarry are obtained from a marble containing calcite, dolomite, and quartz. Use data presented in the table below showing major diffraction peaks of these minerals to calculate the 2 θ positions of the two most intense peaks of each minerals on a diffractogram of a powdered sample of the crushed stone analyzed using Cok α X-ray radiation with $\lambda=0.179\text{ nm}$. Show calculations to support your answers. (7.5 marks).

X-ray diffraction peaks quartz, calcite and dolomite.

Quartz		Calcite		Dolomite	
d (nm)	Intensity (%)	d (nm)	Intensity (%)	d (nm)	Intensity (%)
0.427	22	0.304	100	0.289	100
0.334	100	0.250	14	0.241	7
0.245	8	0.229	18	0.219	19

5. The clay fraction of a soil from Liempe Farm was analyzed by X-ray Diffraction Analysis and found to contain kaolinite, mica, goethite and quartz. A chemical analysis of the clay fraction showed that it contained 1.6 % K. A Thermal Gravimetric Analysis (TGA) of a 110 mg of the clay showed a weight loss of 2.0 mg at 400°C and a further weight loss of 10 mg at 550° C. Given that Goethite (FeOOH) undergoes a transformation to Hematite (Fe₂O₃) at 400°C and that α -quartz (the common form of quartz found in soil) undergoes an exothermic phase change to β -quartz at 573°C and that kaolinite (Al₂Si₂O₅(OH)₄) undergoes dehydroxylation at 550°C. Answer the following questions: (20 marks)
- Sketch a fully labelled Differential Thermo Analysis (DTA) thermogram of the results of the analysis of this clay sample indicating the changes occurring at specified temperatures. (3 marks)
 - Assuming that all the potassium in the clay sample is associated with the mica present in the sample whose composition is KAl₂(Si₃Al)O₁₀(OH)₂, calculate the percentage of mica in the sample. (4 marks)
 - Using the information given on the TGA of the sample in the opening statement, calculate the percentages of kaolinite and goethite in the sample. (6 marks)
 - Given that the CECs of the minerals present in the clay sample are 30 cmol (+).kg⁻¹ for the mica; 5 cmol(+).kg⁻¹ for kaolinite; 0 cmol(+).kg⁻¹ for Goethite and Quartz, calculate the CEC in cmol(+) per kg of clay in this soil. (5 marks)
 - Given that clays with less than 16 cmol (+).kg⁻¹ are classified as 'low activity clays', does this soil qualify to be classified as having low activity clay? Explain why (2 marks)

Useful Atomic masses:

Ca=40g, K=39g, Si=28g, O=16g, Al=27g, Na=23, Fe=56g H=1 g, Mg=12 g, C=12g

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
FIRST SEMESTER EXAMINATIONS-FEBRUARY 2012/2013
AGS 441: AGRICULTURAL HYDRAULICS AND HYDROLOGY

Time: Three (3) Hours

Total Marks: 100

Instruction: Answer all Questions

1. Briefly define the following terms. (20 marks)
 - a. Impeller
 - b. Stagnation point
 - c. Simple climate departure index
 - d. Burdon gauge
 - e. Hydrograph
 - f. Bernoulli's equation
 - g. Reynolds number
 - h. Stilling basins
 - i. Beneficial precipitation
2. Answer the following questions precisely and concisely: (10 marks)
 - a. Distinguish between inter and intra seasonal variability of rainfall. (4 marks)
 - b. Explain the seasonal and temporal precipitation concentration index. (6 marks)
3. The Table below shows the amount of rainfall received for Lusaka Province in Zambia.

Name of Station	Area (Km ²)	Rainfall (mm)
KK Airport	20	900
Chilanga	40	800
Kafue	20	700
UNZA	10	900
Chirundu	30	680
ZAF Lusaka	20	850

Answer the following questions: (20 marks)

- a. Calculate the regional rainfall using the Thiessen polygon method. (4 marks)
- b. What is the return period of receiving rainfall of 600 and 1000 mm for Lusaka? (4 marks)
- c. Determine the optimum number of rain gauges required for Lusaka within a 10 % error margin. (4 marks)
- d. What is the additional number of rain gauge stations required for Lusaka Province? (2 marks)
- e. Assuming the rainfall data was collected at one station over a 6 years period, calculate the climatic departure index and give an indication of the state of aridity. (4 marks)
- f. Lusitu District experiences floods once every 10 years. What are the chances that another flood of that magnitude will occur next year? (2 marks)

4. A pipe is using a pitot tube with a normal pipe operating pressure of 200 kNm^{-1} and a pitot pressure of 500 kNm^{-1} . Calculate the following: **(10 marks)**
- The velocity of water in the pipe (3 marks)
 - The pressure of water in the pipe at a point 2 that is 10 m above point 1. (3 marks)
 - The discharge if the diameter of the pipe is 0.05 m. (4 marks)
5. Given that a channel has a Froude number of 2.78 and width of 2.3 m with a downstream depth of 0.87 m and velocity of 4.34 m s^{-1} . Calculate the following: **(20 marks)**
- The upstream depth (4 marks)
 - The discharge of the channel (4 marks)
 - The discharge in litres/hour, if it is in a pipe (4 marks)
 - The amount of water which can be delivered using the pipe in 10 hours (4 marks)
 - The energy loss in the jump (4 marks)
6. A pressurized irrigation system was designed for a 30 ha farm in Chanyanya in Kafue, Zambia. The selection of pumps required the use of the manufacturer's curves attached on pages 3 and 4, and the following are the site data.

Parameter	Value
Hydraulic head	23 m
Discharge	$70 \text{ m}^3/\text{hr}$
Elevation	1500 m
Static suction	2 m
Suction pipe friction losses	0.5 m
Maximum temperature	35°C

Answer the following questions: **(10 marks)**

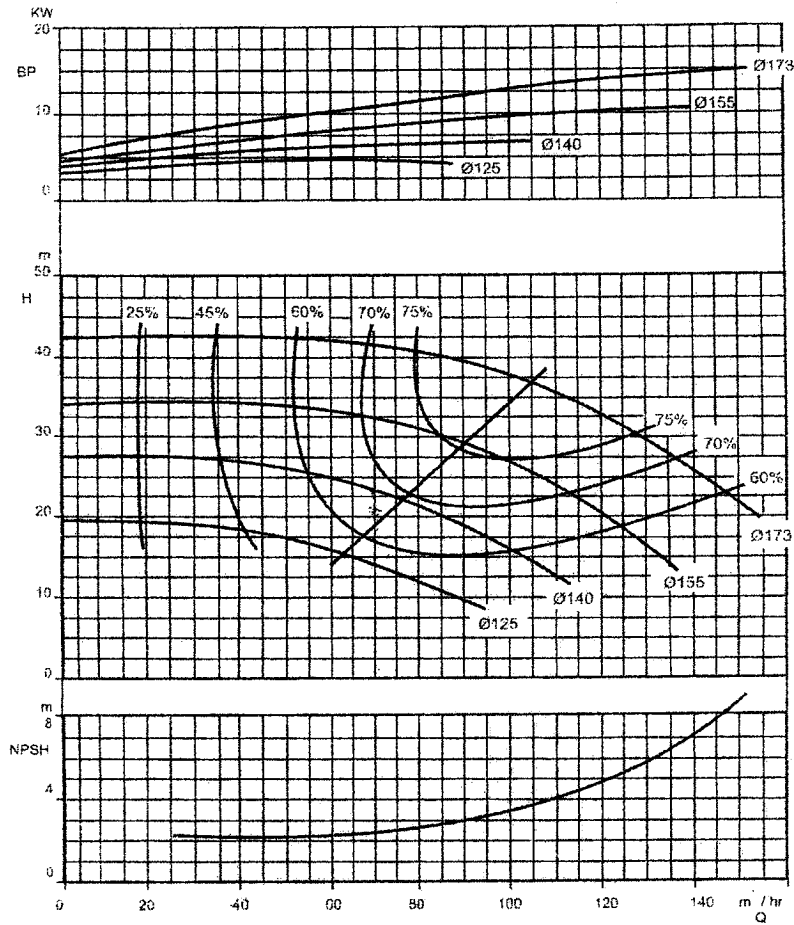
- Given that the vapour pressure of water is 0.58 m, calculate the NSHPA of the pump (2 marks)
 - Estimate the NSHPR. (1 mark)
 - State whether there is cavitation and give two ways of reducing cavitation. (3 marks)
 - What is the efficiency of the pump? (2 marks)
 - What is the suitable size of the impeller to be used? (2 marks)
7. Explain the differences between channels and pipes. **(10 marks)**

End of Exam

Manufacturer's curves used for pump selection of question 6.

Irigation manual

Figure 25a
Performance curve of a pump (Source: Stork Pumps, undated)





**UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

UNIVERSITY FIRST SEMESTER EXAMINATIONS-FEBRUARY/MARCH 2012/2013

AGS 531: LAND EVALUATION AND IMPROVEMENT

Instruction: Answer all Questions. Time: Three (3) Hours Total Marks: 100

1. Ideally, land evaluation procedures involve three main stages.
 - a) What are the three main stages in the land evaluation process? (3 marks)
 - b) Discuss the main characteristic features of each of the stages involved (15 marks)

2. Explain the following concepts in land evaluation (12 marks)
 - a) Land use adaptation
 - b) Land use system
 - c) Farming system
 - d) Improvement land qualities

3. Qualitative and quantitative land evaluation methods have different approaches in the process of evaluation. However, they may be considered to be similar in the sense that they involve equivalent steps in their operation. Suggest what these steps are and clearly explain how they differ from each other. (10 marks)

4. 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) Availability of rooting space
 - (ii) Suitability for mechanized operations
 - (iii) Resistance to erosion
- b) With suitable examples, compare and contrast between land suitability class and land suitability order (5 marks)

5. 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 (KR)/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 KR 190 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. (15 marks)

6. Given two categories of farming, small scale and commercial farming. Where would one expect the problem of decline in soil productivity to be more serious? Give reasons to support your (10 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 the table below and in Annex 1 and 2 where necessary, answer the questions that follow:

Factor	Factor rating (0- 100 points)
Protected resource lands	62
Surrounding agricultural lands	39
Water resource availability	70
Project size	31
Land capability class	40
Storie Index	60

- 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) units

Land Capability Classification	LCC Point Rating
I	100
Ile	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 <u>only</u> if LE AND SA sub-scores are each <u>greater</u> than or equal to 20 points
60-79	Considered significant <u>unless</u> either LE <u>or</u> SA sub-score is less than 20 points
80-100	Considered significant

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE

FIRST SEMESTER FINAL EXAMINATION

AGS 551

PLANNING AND DEVELOPMENT OF IRRIGATION AND DRAINAGE SYSTEMS

INSTRUCTIONS: Answer ALL questions

ALL QUESTIONS CARRY THE SAME NUMBER OF MARKS

Time: 3 Hours

Marks: 100

1. Irrigation is undertaken for a number of reasons. What are these reasons? Explain why water must be or is added to the soil in irrigation. Why do crops generally perform better under irrigation. (20 Marks)
2. In sprinkler irrigation systems it is important that water is applied as uniformly as possible to the whole field. A number of factors must be considered and carefully observed during design for this to be achieved. What are these factors and what is it that must be done to ensure that water is applied uniformly to the field. (20 Marks)
3. Describe sprinklers used in sprinkler irrigation systems. Describe also emitters as used in drip irrigation. What do these two do? What is necessary for each of these to work properly? Explain similarities and differences between the sprinklers and the emitters. (20 Marks)
4. In drip irrigation systems, one of the important components is the control head. What is this component's role or job? What is it composed of or is made of and what do the components actually do or perform? (20 Marks)
5. Explain what border irrigation is and what furrow irrigation is? In both border and furrow irrigation deciding the length of the border and the furrow is one of the most important considerations in the success of the system. Explain to a layperson how or the steps that are undertaken to help the designer to determine the length of the furrow and the border. (20 Marks)

END



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

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 m³ 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 $\text{Ca}_5(\text{PO}_4)_3\text{F}$.
- 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 ($\text{KAl}_2(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_2$) to kaolinite $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$ 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
							$\text{gH}_2\text{O/cm}^3$
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 $1.98 \times 10^{-5}\text{ m}^2\text{s}^{-1}$, calculate the rate of diffusion of oxygen through the soil in $\text{kg.m}^{-2}\text{s}^{-1}$ between the surface of the soil and 25 cm soil depth, using data provided in question (i). (4 marks)

SMILE SOIL SCIENCE IS FUN

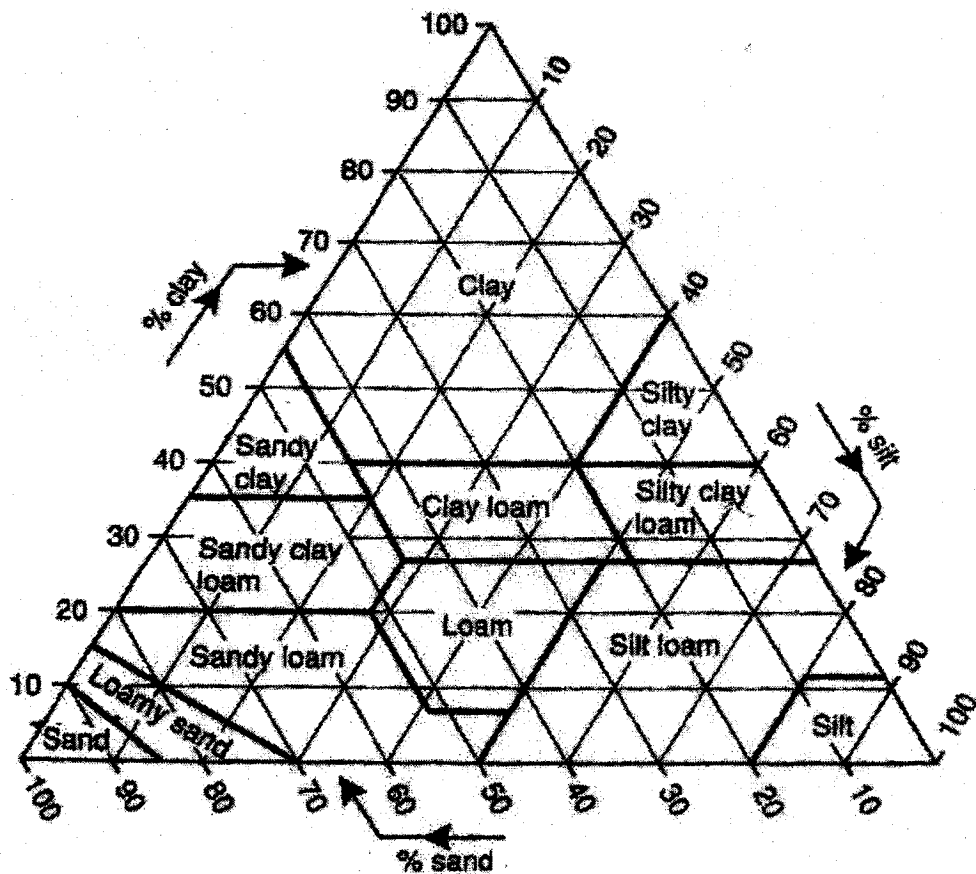
AGS 2011 EXAMINATION

INSTRUCTIONS: DETACH THIS PAGE FROM QUESTION PAPER AND SUBMIT IT
TOGETHER WITH YOUR ANSWER BOOKLETA

COMPUTER NO:.....

QUESTION 4a:

USDA TEXTURAL TRIANGLE



**UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

**UNIVERSITY FIRST SEMESTER EXAMINATIONS – FEBRUARY, 2013
AGS 3701- AGROCLIMATOLOGY**

TIME: 3 hours

MARKS: 100

INSTRUCTIONS: Answer all questions

Some useful constants: $S_o = 1368 \text{ Wm}^{-2}$, $\epsilon = 0.95$, $\sigma = 5.67 \times 10^{-8} \text{ Wm}^{-2} \text{ K}^{-4}$, $P_o = 101.3 \text{ kPa}$,
 $G_{sc} = 0.0820 \text{ MJm}^{-2}$

1. Briefly define each of the following terms: **(25 marks)**
 - a. Tropopause
 - b. Planetary boundary layer
 - c. Convection
 - d. Black body
 - e. Specific humidity
 - f. Dew point temperature
 - g. Rain shadow
 - h. Climate
2.
 - a. Explain the 'Greenhouse Effect'. Which atmospheric components are thought to be responsible for this effect? *(5 marks)*
 - b. Show that the effective temperature of the earth at the top of the atmosphere is 258 K. *(5 marks)*
3. Briefly discuss any three ways in which agriculture negatively contributes to climate change. Suggest two ways to mitigate against the practices you have mentioned. *(10 marks)*

4. Given the following meteorological data measured on September 20, 2012 at UNZA Farm in Chongwe (28.47° E, 15.396° S and altitude 1162 m). **(25 marks)**

$$R_a = 36 \text{ MJ m}^{-2} \text{ day}^{-1}, \omega = 1.57 \text{ rad}, n = 8.75 \text{ hours}$$

Determine:

- The Solar radiation (R_s). *(3 marks)*
 - The equivalent evaporation of R_s as a depth of water in mm day^{-1} . *(2 marks)*
 - If the equivalent evaporation of Radiation during an overcast day (depth of water in mm/day) is assumed to be the average transpiration for each soya bean plant during its growth cycle, how much water will be transpired from 1 Lima of soya beans with the spacing of 60 x 15 cm (in $\text{m}^3/\text{lima/day}$)? *(10 marks)*
 - Suppose the area receives an average of 30 mm/5 days of rainfall during the crop cycle (150 days) and only 75% of this infiltrates the soil and is available for plant use. How much water from the rain will be available for plant use during the crop cycle (in m^3/lima)? *(8 marks)*
 - What are the primary factors that influence evaporation? *(2 marks)*
5. You are part of a multi disciplinary team engaged by the Government of Zambia to determine the suitability of rice production on a 5,000 ha land in Mazabuka District of the Southern Province. **(30 marks)**

Month	T min (°C)	T max (°C)	P (mm)	ET (mm)	RH (%)	n (hr d ⁻¹)	N (hr d ⁻¹)	Wind* (m s ⁻¹)
January	21.2	25.3	229.9	121.8	74	5.8	12.9	3.7
February	22.4	25.1	204.8	134.9	71	8.0	12.6	5.4
March	20.5	24.3	193.5	128.0	75	6.0	12.2	5.2
April	16.4	23.1	1.0	155.5	64	9.6	11.8	6.3
May	16.5	24.6	29.4	139.9	64	10.1	11.4	5.4
June	13.8	23.5	0.0	140.9	62	9.8	11.2	6.2
July	14.0	22.1	0.0	139.3	57	9.3	11.3	7.4
August	17.0	23.1	0.0	200.8	52	10.7	11.6	7.5
September	21.8	28.6	0.0	251.7	51	10.3	12.0	8.4
October	22.1	29.7	4.9	291.6	52	10.1	12.5	9.0
November	20.2	28.3	224.0	161.7	67	6.7	12.8	0.0
December	21.4	26.4	65.5	171.0	69	7.9	13.0	4.9

*Wind speed measured at 1.5 m height

Crop data:

Crop: Rice
Crop cycle length: 120 days
Start crop cycle: 1 December
End crop cycle: 30 March

- a. Given the climatic information and crop climatic requirements;
 - i. Evaluate the climatic suitability of the crop in this area. *(10 marks)*
 - ii. Determine the overall climatic suitability class of the area. *(2 marks)*
 - iii. Suppose 1,000 ha of this land is to be put under irrigation. List any three (3) climatic parameters that would be vital for your evaluation. *(3 marks)*
- b. Using the FAO Growing period model, determine the following:
 - i. The month when the rain begins and ends. *(1.5 marks)*
 - ii. The month the growing period begins and day it ends. *(3 marks)*
 - iii. The type and quality of the growing period. *(3.5 marks)*
 - iv. The month you would recommend for sowing. *(1 mark)*
 - v. List and briefly explain any three limitations of the FAO growing period analysis. *(6 marks)*

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

FINAL EXAMINATIONS-NOVEMBER 2011

AGS 6141 PLANT NUTRITION

TIME: 3 hours

Marks: 100

ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1. Define the following:
 - a) Micronutrient
 - b) Metabolism
 - c) Michaelis constant
 - d) Water potential
 - e) Rhizosheath [15 Marks]
2. The supply of water is important for growth of plants.
 - a) What is permanent wilting point? [2 Marks]
 - b) Would the permanent wilting point be reached when there is the same amount of water remaining in a clay soil and a sandy soil? Explain and giving reasons. [4 Marks]
3. The transport of nutrients in the plant is important.
 - a) Explain clearly how radial transport of nutrients across the roots is achieved, giving pathways involved and examples of nutrients transported. [10 Marks]
 - b) Discuss the radial transport of water. [5 Marks]
4. Discuss in detail and within the time allocated, the important factors that control the supply of nitrogen to plants. [20 Marks]
5. Discuss the challenges of growing a maize crop in saline soils and how best to overcome those challenges. [10 Marks]

6. Explain what is meant by C₄ and C₅ pathways of CO₂ fixation.
[6 Marks]
7. Root Development is of great importance to the nutrition of plants.
- a) Discuss the main environmental factors that affect (control) root growth. [4 Marks]
 - b) How do the following affect root growth?
 - i. soil compaction [3 Marks]
 - ii. cattle grazing [3 Marks]
 - iii. placement of fertilizers [3 Marks]
8. Describe two (2) main functions of the following plant nutrients and give one type of plant or crop for which they are more important.
- a) sulphur
 - b) phosphorus
 - c) chlorine
 - d) molybdenum
 - e) calcium [15 Marks]

.....

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY FIRST SEMESTER EXAMINATIONS – NOVEMBER 2011

AGS 6411: Applied Soil Chemistry

INSTRUCTIONS: Answer all questions and write legibly. Shorthand in text is not permitted.

Time: 3 Hours

Marks: 100

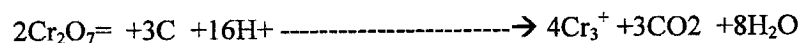
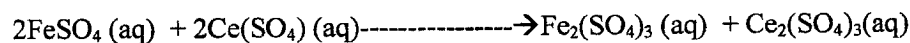
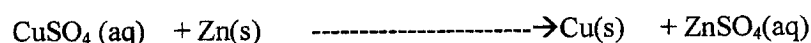
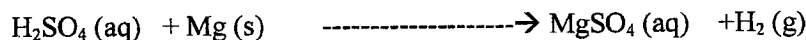
1. a) Define the term “potential determining ion” (pdi) [2]
b). Demonstrate how pdi determine charge development on the surfaces of a silver iodide particle, humus, sesquioxide, and broken edge of a 1:1 clay mineral. [10]
2. List four soil properties that commonly limit growth of plant roots, and explain how each constraint might be identified or diagnosed in the field. [8]
3. a) Show the reactions of agricultural lime in an acid soil and describe the changes in soil chemical properties that occur [6]
b). Why might the growth of an acid-tolerant plant at low pH be normal on an organic soil (e.g. peat) but completely fail in a mineral soil? [8]
4. *Jatropha (Jatropha curcas)* seed cake contains 4 % organic nitrogen. How much N would be mineralized in 8 weeks following application of 6 ton/ha, of seed cake given that the mineralization rate of the cake is 0.1403 week^{-1} [8]
5. A- 5 t ha^{-1} crop of maize transpired $3.2 \times 10^9 \text{ g}$ of water per season per ha. If the average P concentration in the soil solution was 3 mg dm^{-3} and an adequate P content in the plant is 0.2 %, would mass flow supply adequate P to meet the plant requirement? How much would be the excess or deficit in terms of P_2O_5 equivalent? [10]
6. a) Four 100 cm^3 portions of ethanoic acid (acetic acid) were equilibrated with 2 g portions of powdered charcoal. The following data were recorded:

Initial concentration (mole dm^{-3})	Equilibrium concentration (mole dm^{-3})
0.050	0.041
0.075	0.064
0.125	0.111
0.200	0.183

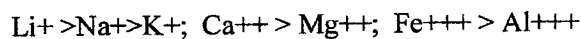
Analyze the data according to the Freundlich adsorption model and evaluate the constants n and K [10]

- b). In the linear form of the Langmuir Equation for the adsorption on a substance onto a surface, C_e/x_m is plotted against C_e and a linear graph is obtained. Given that the C_e was in $\mu\text{g cm}^{-3}$ and m in g, derive the units for C_e/x_m , and the constants k and b. [10]

7. In each of the following reactions indicate which element is undergoing oxidation and which is being reduced: [8]



8. a). For a soil that contains 30 % clay, 50 % sand, 20 % silt has a CEC of $20 \text{ cmol}(+)\text{kg}^{-1}$. Determine the probable clay mineral type? [4]
- b). If 10 cm of top soil containing $0.25 \text{ cmol kg}^{-1}$ of K and having a bulk density of 1300 kg m^{-3} is eroded annually, calculate the total loss of K_2O in kg ha^{-1} [10]
- c). Explain the following orders of colloid preference in adsorption of ions from the soil solution (Lyotropic series):



[6]

END OF EXAMINATION PAPER

UNIVERSITY FIRST SEMESTER EXAMINATIONS

DECEMBER 2011

AGS 6431: SOIL MICROBIOLOGY

TIME: 3 HOURS

TOTAL MARKS: 100

ANSWER ALL QUESTIONS

1. Denitrification is an undesirable process in agricultural soils because 'nitrogen is lost'.
 - a. Explain why this process is important to soil microorganisms [10 marks]
 - b. Show the sequential changes in forms and oxidative states of soil nitrogen during this process [5 marks]
 - c. Describe how this process can be used by water and sewerage companies to reduce surface or ground water pollution [10 marks]
2. Discuss soil bacteria under the following
 - a. *Pleomorphism* [3 marks]
 - b. *Heterotrophism* [3 marks]
 - c. Gram stain classification [4 marks]
 - d. Importance in different soil nitrogen transformations [10 marks]
3. Using appropriate examples, briefly describe the application of the following procedures in studying soil microorganisms
 - a. Enrichment cultures [10 marks]
 - b. Buried slide technique [10 marks]
4. Mycorrhizae are relationships between plant roots and fungi that provide various benefits to the fungus, the host plant and the environment.
 - a. Describe the methodology you would use to study the effect of mycorrhizae on uptake of phosphorus in cabbage [20 marks]
 - b. Explain why a mycorrhizae relationship would be more important in cabbage than in sorghum for P uptake [5 marks]

-End-

UNIVERSITY OF ZAMBIA

School of Agricultural Sciences

UNIVERSITY SECOND SEMESTER EXAMINATIONS—MAY/JUNE, 2012

AGS 6432: Soil Amendments and Fertilizer Technology

TIME: 3 Hours

MARKS: 100

INSTRUCTIONS: ANSWER ANY FIVE QUESTIONS FROM SECTION A AND ALL FROM SECTION B. WRITE LEGIBLY AND DEMONSTRATE LOGICAL DEVELOPMENT OF THE ANSWERS.

SECTION A

1. An economical combination of organic residues and chemical fertilizer is not just complementary ($2 + 2 = 4$) but actually synergistic ($2 + 2 = 5$). Explain the synergistic effect of the combination of organic residues and chemical fertilizer on soil productivity [10]
2. a). What is meant by the terms “primary” and “secondary” plant nutrients? [2]
b). List all the plant nutrients under the headings “primary” and “secondary” [8]
3. a). Define the term “metal”, giving the distinguishing characteristics [2]
b). Which of the 16 essential plant nutrient elements are metals and which are non metals? [8]
4. a). Explain the meaning of the statement “balanced plant nutrition through fertilization” [3]
b). Enumerate several alternatives to use of chemical fertilizers under each of the following headings: Rational substitutes, rational partial substitutes and non rational substitutes. [7]
5. Explain the primary technical services provided by the International Fertilizer development Centre (IFDC). [10]
6. Describe specific strategies that can be used to make fertilizer profitable to smallholder farmers and thereby encourage them to buy and use more. [10]
7. a). Explain the “more hectares” and “more yield per hectare” options to increasing food production” [6]
b). Which of the two options is most applicable to Sub-Saharan Africa and why? [4]

SECTION B

1. A fertilizer importer quotes you the following prices: 3-12-12 for \$125 per ton and 10-10-10 for \$230 per ton. Given that straight fertilizers urea, KCl and single superphosphate cost ZK 195,000, 220,000 and 300,000 per 50 kg bag respectively on the local market, which of the imported product gives the best value for money? Take \$1.00 = ZK 5,200. [15]
2. a). The production of ammonia from natural gas using the Haber Bosch Process is expressed as:
$$7\text{CH}_{4(g)} + 10\text{H}_2\text{O}_{(g)} + 8\text{H}_{2(g)} + 2\text{O}_{2(g)} \longrightarrow 16\text{NH}_{3(g)} + 7\text{CO}_{2(g)}$$
Using thermodynamic data provided, determine whether the reaction is endothermic or exothermic. [10]
- b). Show by way of reaction equations how H_2 can be obtained from coal. [5]
3. a). Explain how efficient use of fertilizer can save energy? [10]
- b). Provided with ammonium sulphate (21 % N and 24 % S), urea, triple super phosphate and muriate of potash, demonstrate how you would prepare one ton of a fertilizer blend of grade 10 : 15 : 15 + 10 % S. [10]

END

**UNIVERSITY OF ZAMBIA
SECOND SEMESTER EXAMINATIONS**

AGS 6442

**SOIL MINERALOGY
7 JUNE 2012**

Instructions: Answer all questions:

Time: 2 hours

1. Define the following terms: (15 marks, 1.5 marks each)
 - a) Sand
 - b) Igneous rock
 - c) Isomorphism substitution
 - d) Amorphous mineral
 - e) Crystal habit
 - f) $C 2/m2/m2/m$
 - g) $\{010\}$
 - h) Cyclosilicate
 - i) Euhedral crystal
 - j) Constructive interference
2. Indicate whether the following statements are true or false or you do not know the correct answer: (15 marks (1.5 marks for correct answer, -0.5 mark for wrong answer, 0 for I do not know)
 - a. $MgFeSiO_4$ is the formula of Olivine which is a secondary mineral
 - b. $Na_{0.4}(Mg_{0.4}Al_{1.6})Si_4O_{10}(OH)_2$ is a vermiculite.
 - c. Silicon, Oxygen, and Calcium are the three most abundant elements in the earth's crust.
 - d. Aluminium can replace sodium in the crystal structure of albite ($Na(AlSi_3)O_8$).
 - e. It is not common to find gypsum ($CaSO_4 \cdot 2H_2O$) in Oxisols.
 - f. A mineral belonging to the hexagonal system has 3 axes that are equal in length and a b-axis perpendicular to these three axes.
 - g. In Goldich's weathering series, orthoclase is more resistant to weathering than muscovite.
 - h. A 2 fold rotary inversion axis involves a rotation through 120° followed by an inversion about the centre of the crystal.
 - i. Thermogravimetric analysis is both a qualitative and quantitative method of analysis
 - j. The dehydroxylation of kaolinite is an endothermic reaction.

- 3 The formulas of minerals commonly found in soils are given below; SiO_2 , $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$, $\text{Al}(\text{OH})_3$, $\text{K}(\text{AlSi}_3)\text{O}_8$, $(\text{MgFe})\text{SiO}_4$ and $\text{KAl}_2(\text{AlSi}_3)\text{O}_{10}(\text{OH})_2$. Answer the following questions: (20 marks):

- i. Give the names of all the minerals whose formulas are given above and indicate whether they are primary or secondary minerals. (4.5 marks)
- ii. For the minerals that are silicates, indicate the name of the structural group to which they belong. (2.5 marks)
- iii. List which minerals have isomorphous substitution in their structures and indicate the ions involved in the substitution as well as their coordination numbers with oxygen. (3 marks)
- iv. For the primary silicate minerals in the above list, indicate their order of crystallization from magma, starting with the first to crystallize at high temperatures to the last to crystallize. (3 marks)
- v. List all the above minerals in order of their relative resistance to weathering under humid soil environments, starting with the least resistant to the most resistant. (4 marks)
- vi. Which three of the above minerals would you expect to find in the clay fractions of highly weathered soils? Give reasons to support your answer. (3 marks)

- 4 Kaolinite and smectites are common clay minerals in soils. Smectites are common in soils in the intermediate stage of weathering and exhibit shrinking and swelling characteristics, which are associated with high surface areas and high cation exchange capacities. On the other hand, Kaolinites is common in highly weathered soils and show limited expansion and have low CECs.

Answer the following questions. (20 marks)

- a) Write the chemical formulas of kaolinite and smectite. (4 marks)
- b) Draw a schematic diagram of each of the above minerals and indicate: (i) the planes in which the elements you have indicated in your formula occur (ii) the tetrahedral sheet (iii) the octahedral sheet (iv) the layer structure and (v) the interlayer space. (7 marks)
- c) Explain which Kaolinite has a low CEC shows limited expansion and why smectites have a high CEC and show significant expansion and contraction. (4 marks)
- d) Calculate the CEC of the Smectite whose formula you wrote in part (a) of this question. (5 marks)

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- d) Calculate the CEC of the Smectite whose formula you wrote in part (a) of this question. (5 marks)

5. Soils in low lying areas of dry environments tend to accumulate carbonate minerals and soluble salts often referred to as evaporates. The common constituents of evaporates are usually, calcite, (CaCO_3) gypsum, ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), and thernadite (Na_2SO_4). The crystallographic properties of the minerals are given below:

Mineral	a (Å)	b (Å)	c (Å)	d Å	α	β	γ
Calcite	4.99	4.99	17.06	4.99	90°		
Gypsum	5.68	15.18	6.29	-	90°	113°50'	90°
Thernadite	5.86	12.30	9.82	-	90°	90°	90°

Answer the following questions: (30 marks)

- To which crystal systems do gypsum, calcite and thernadite belong? Give reasons to support your answer. (5 marks)
- What are the axial ratios of the three minerals? (2 marks)
- Given that the main X-ray diffraction peaks are 0.756 nm for gypsum; 0.549nm for thernadite, and 0.034 nm for calcite, calculate the 2θ positions at which you would expect to find the main peaks for each of these minerals on a diffractogram produced by diffractometer using $\text{CuK}\alpha$ radiation with $\lambda=0.1542$ nm. (6 marks)
- Using the thermodynamic data provided below, calculate the solubilities of these minerals in water at 25°C in moles/liter and indicate which mineral will be the first to disappear from the soil in the rainy season. Give reasons to support your answer. (12 marks)
- Given that gypsum loses its two water molecules to form anhydrite (CaSO_4) at 150°C, while calcites loses CO_2 at 970°C to form lime (CaO), calculate the percentages of gypsum and calcite in a sample of soil containing gspum and calcite if a Thermogravimetric analysis of a 100 mg sample of the soil shows a weight loss of 4 mg at 150°C and a weight loss of 6 mg at 970°C. It is assumed that the weight losses at 150°C and 970°C are attributed to decompositions of gypsum and calcite respectively. (10 marks)

Useful data: Atomic masses: Ca=40 g, S=32g, O=16g, C=12g, H=1g, Na=23

Thermodynamic data

Species	ΔG_f° (kJ.mol ⁻¹)
CaCO_3	-1128.8
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	-1795.7
H_2O	-237.4
Na_2SO_4	-1266.8
Ca^{2+}	-553.0
Na^+	-261.9
CO_3^{2-}	-528.1
SO_4^{2-}	-744.5

END OF EXAMINATION



UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST SEMISTER EXAMINATIONS
NOVEMBER 2011

AGS 6521: APPLIED SOIL PHYSICS

Time: Three (3) Hours

Marks: 95

Instruction: Answer all Questions

1. Briefly define each of the following terms: [10 marks]
 - a) Wilting point
 - b) Soil water diffusivity
 - c) Basic infiltration
 - d) Laplace equation
 - e) Soil water capacity
2. Briefly discuss the main principles of the TDR technique in *situ* soil water content measurements [10 marks]
3. The application of the general flow equation depends on a number of factors. Describe briefly the main factors that affect its application [10 marks]
4. An overhead (pivot) irrigation system at UNZA Farm under maize crop was set up based on the following field data: [20 marks]

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

- a) Determine the available water-holding capacity (AWC) of the soil profile to a depth of 1 meter (*mm*)
- b) How deep (in *meters*) would a 40 mm irrigation infiltrate the soil if the soil water content is maintained at field capacity and assuming that the water content in the profile is at wilting point
- c) Determine the total depth of air (D_a) for the entire profile if the water content is maintained at field capacity
- d) What three measures would you take in order to increase the available water-holding capacity of this soil

5. A rice field in Chama has a soil profile consisting of an upper layer of 20 cm and a lower layer of 80 cm with hydraulic conductivities of $4 \times 10^{-4} \text{ cm s}^{-1}$ and $5 \times 10^{-5} \text{ cm s}^{-1}$, respectively. If the water depth on the field is maintained constantly above the soil surface, the water discharge (Q) from a surface area of 20 cm^2 at the bottom layer is $1.2 \text{ cm}^3 \text{ min}^{-1}$: [25 marks]
- Determine the height of water on the soil surface that is required to maintain this constant water discharge
 - Determine the soil water potentials (z , h and H) at (i) the bottom, (ii) interface between the two layers, (iii) interface with water and (iv) at the water surface
 - If one more soil layer of 20 cm is added in the middle and the flux reduces by half, calculate (i) the effective hydraulic gradient and (ii) the hydraulic conductivity of the new layer
 - What two measures can you undertake in order to decrease the hydraulic conductivity of the surface layer
6. Given the following soil moisture and hydraulic head measurements using a neutron probe and tensiometers in an irrigated maize field at the University Farm, [25 marks]

Depth (cm)	July 1		July 8	
	H (cm)	θ_v (%)	H (cm)	θ_v (%)
10	-288.2	16.8	-458.2	7.5
30	-202.5	18.6	-275.5	15.9
50	-186.1	17.3	-205.0	16.2
70	-187.4	16.8	-202.5	16.7
90	-191.2	24.1	-206.2	24.2
110	-241.6	15.2	-242.8	15.5

Determine:

- The depth of the plane of zero flux during this period
- The change in soil water storage from the surface to the plane of zero flux in $\text{m}^3 \text{ ha}^{-1}$
- The amount of water loss in the profile through (i) soil surface and (ii) depth below 110 cm
- The average unsaturated hydraulic conductivity [$K_{(\theta)}$] in mm day^{-1} at a soil depth of 100 cm during this period

End of Exam



UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS-MAY, 2012

AGS 6532: SOIL CONSERVATION

Time: Three (3) Hours
Instruction: Answer all Questions

Marks: 100

Non-programmable calculators are allowed

1. Biological processes are important for optimal soil health:
 - a) Discuss how toxic compounds and land management induce soil biological degradation. **(10 marks)**
 - b) Explain why it is important to use ecological principles when dealing with soil biological degradation. **(5 marks)**
 - c) Propose ways in which soil biological degradation can be controlled and good soil health maintained. **(10 marks)**
2. Describe water conservation and technologies that can be applied in order to maintain and sustain soil productivity on a farm **(15 marks)**
3. A runoff plot had a dimension of 25 m by 4 m with an installed runoff collection system capable of collecting 1% of the runoff. The total runoff collected after a 25 mm rainfall was 10 litres with a sediment load of 5 grams per litre, calculate: **(15 marks)**
 - a) Runoff depth in (i) mm and (ii) m^3/ha
 - b) Percentage of runoff (%)
 - c) Total sediment lost from the plot (in kg)
 - d) Total soil erosion per ha (in ton/ha)
 - e) List the components of the universal soil loss equation

4. Selected chemical properties of the surface layer of a Zambian soil are given below:

Soil Depth (cm)	pH (H ₂ O)	Ca -----cmol/kg-----	Mg	K	Na	CEC	Bd g/cm ³
0-25	8.4	2.51	2.74	0.74	7.49	13.48	1.65

Answer the following questions related to the above soil:

- a) In which one of the three Agro-ecological Zones of Zambia would you expect the above soil to most likely occur? Give reasons to support your answer. **(4 marks)**
- b) An Investment firm intending to use land with this type of soil approaches you to assist it in estimating the quantities of gypsum required to reduce the ESP of the soil to 10% as advised by its consultant. Calculate the amount of gypsum required per hectare, to reduce the ESP to 10 % in the top layer assuming that the gypsum available on the market is 92 % pure. **(5 marks)**
- c) The same firm wants to find out the amount of elemental sulfur required to reduce the pH of the soil to pH 6.5. The amount of acid required to neutralize the alkalinity in the soil is given by the equation below:

$$x = -22.588 \ln \left(\frac{pH - 4.73}{3.5} \right)$$

where x = milli-equivalent of H⁺/100g soil and pH = desired pH value.

Calculate the amount of pure elemental sulphur required to reduce the pH of this soil to pH 6.5 per hectare of the top soil later. **(5 marks)**

5. Soil acidity is a major limitation to crop production in many Zambian soils. Answer the following questions to the management of soil acidity:
- a) Mention two causes of acidity in Zambian soils and describe how they lead to the development of soil acidity. **(4 marks)**
- b) An area with sandy soils that were initially slightly acid has been under continuous cultivation for 10 years receiving annual applications of 400 kg of Ammonium nitrate per hectare. Assuming that 50 % of the NH₄ in the fertilizer is nitrified and that the acid produced remains in the soils, calculate the amount of lime required to neutralize the acidity introduced by the nitrification of the fertilizer per hectare. The available lime has an NV of 85 % and the soil has a plough layer 20 cm thick and a bulk density of 1.4g.cm⁻³. **(5 marks)**
- c) Conservation farming has become a major farming practice in Zambia that is being widely promoted by the government. A plot of land with strongly acid soil intended for cultivation using planting basins has an ECEC of 4.5 cmol/kg soil, a base saturation of 60 % and bulk density of 1.45 g.cm⁻³. Assuming that all the exchangeable acidity in the soil is due to exchangeable aluminium answer the following:

- (i) If it is desired to reduce the aluminium saturation to 5 %, calculate the amount of lime in grams required per planting basin given that the dimensions of the basins are 15 cm x 30 cm x 20cm and the neutralizing value of the lime is 87%. **(5 marks)**
- (ii) Express the lime requirement in kilograms per Lima given that there are about 16,000 basins per hectare? **(2.0 marks)**
- 6 The quality of water used for irrigation is an important factor that needs to be taken into account before embarking on a major irrigation scheme. You are given the following results of an analysis of a water sample from Sinazeze intended for use in irrigation :

Ca ²⁺	Mg ²⁺	Na ⁺	K ⁺	Cl ⁻	HCO ₃ ⁻	SO ₄ ²⁻
mg/litre						
33.6	30.1	358	0.6	6.0	969	364.5

Calculate the values of the following quality parameters for the water sample and interpret the results in terms of the suitability of the water for irrigation:

- The EC of the water in (mS/cm) **(2.5 marks)**
- The Sodium Adsorption Ratio **(2.5 marks)**
- The Residual Sodium Carbonate **(2.5 marks)**
- What soil related problems would you expect to develop in fields irrigated with this water over time? **(2.5 mark)**

SOME HELPFUL DATA: Atomic masses of elements: Ca = 40g, Mg=20g, K= 39g, S=32g, Na=23g, Cl =34.5g, H=1g, C=12g, O=16g.

End of Exam



UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS-MAY, 2012

AGS 6542: SOIL AND WATER CONSERVATION

Time: Three (3) Hours
Instruction: Answer all Questions

Marks: 100

Non-programmable calculators are allowed

1. Biological processes are important for optimal soil health:
 - a) Discuss how toxic compounds and land management induce soil biological degradation. **(10 marks)**
 - b) Explain why it is important to use ecological principles when dealing with soil biological degradation. **(5 marks)**
 - c) Propose ways in which soil biological degradation can be controlled and good soil health maintained. **(10 marks)**
2. Describe water conservation and technologies that can be applied in order to maintain and sustain soil productivity on a farm **(15 marks)**
3. A runoff plot had a dimension of 25 m by 4 m with an installed runoff collection system capable of collecting 1% of the runoff. The total runoff collected after a 25 mm rainfall was 10 litres with a sediment load of 5 grams per litre, calculate: **(15 marks)**
 - a) Runoff depth in (i) mm and (ii) m^3/ha
 - b) Percentage of runoff (%)
 - c) Total sediment lost from the plot (in kg)
 - d) Total soil erosion per ha (in ton/ha)
 - e) List the components of the universal soil loss equation
4. Selected chemical properties of the surface layer of a Zambian soil are given below:

Soil Depth (cm)	pH (H_2O)	Ca -----cmol/kg-----	Mg	K	Na	CEC	Bd g/cm^3
0-25	8.4	2.51	2.74	0.74	7.49	13.48	1.65

Answer the following questions related to the above soil:

- a) In which one of the three Agro-ecological Zones of Zambia would you expect the above soil to most likely occur? Give reasons to support your answer. **(4 marks)**
- b) An Investment firm intending to use land with this type of soil approaches you to assist it in estimating the quantities of gypsum required to reduce the ESP of the soil to 10% as advised by its consultant. Calculate the amount of gypsum required per hectare, to reduce the ESP to 10 % in the top layer assuming that the gypsum available on the market is 92 % pure. **(5 marks)**
- c) The same firm wants to find out the amount of elemental sulfur required to reduce the pH of the soil to pH 6.5. The amount of acid required to neutralize the alkalinity in the soil is given by the equation below:

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where x = milli-equivalent of H^+ /100g soil and pH = desired pH value.

Calculate the amount of pure elemental sulphur required to reduce the pH of this soil to pH 6.5 per hectare of the top soil layer. **(5 marks)**

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 - a) Mention two causes of acidity in Zambian soils and describe how they lead to the development of soil acidity. **(4 marks)**
 - b) An area with sandy soils that were initially slightly acid has been under continuous cultivation for 10 years receiving annual applications of 400 kg of Ammonium nitrate per hectare. Assuming that 50 % of the NH_4 in the fertilizer is nitrified and that the acid produced remains in the soils, calculate the amount of lime required to neutralize the acidity introduced by the nitrification of the fertilizer per hectare. The available lime has an NV of 85 % and the soil has a plough layer 20 cm thick and a bulk density of $1.4g.cm^{-3}$. **(5 marks)**
 - c) Conservation farming has become a major farming practice in Zambia that is being widely promoted by the government. A plot of land with strongly acid soil intended for cultivation using planting basins has an ECEC of 4.5 cmol/kg soil, a base saturation of 60 % and bulk density of $1.45 g.cm^{-3}$. Assuming that all the exchangeable acidity in the soil is due to exchangeable aluminium answer the following:

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- (ii) Express the lime requirement in kilograms per Lima given that there are about 16,000 basins per hectare? **(2.0 marks)**
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-----mg/litre-----						
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- The EC of the water in (mS/cm) **(2.5 marks)**
- The Sodium Adsorption Ratio **(2.5 marks)**
- The Residual Sodium Carbonate **(2.5 marks)**
- What soil related problems would you expect to develop in fields irrigated with this water over time? **(2.5 mark)**

SOME HELPFUL DATA: Atomic masses of elements: Ca = 40g, Mg=20g, K= 39g, S=32g, Na=23g, Cl =34.5g, H=1g, C=12g, O=16g.

End of Exam

**The University of Zambia,
School of Agricultural Sciences**

UNIVERSITY 2nd SEMESTER EXAMINATIONS – MAY/JUNE, 2012

AGS 6611: SOIL CLASSIFICATION AND LAND EVALUATION

Time: 3 hours

Total marks: 100

Instruction: Answer all questions.

Q1. In his classic work, “Factors of soil formation”, Hans Jenny articulated a conceptual model of five soil forming factors and some of the interactions between them.

- a. Discuss this model and explain how each of the five factors contributes to soil formation **(5 marks)**
- b. For each of the five soil forming factors, describe a situation where one might find a reasonable soil sequence for that particular factor wherein the other factors are held (relatively) constant **(5 marks)**
- c. How is this model used in soil mapping? **(5 marks)**
- d. What are the main limitations of this model? **(5 marks)**

Q2. The soil evolutionary theory identifies convergent (starts different and converges to the same) and divergent (starts similar but evolves differently) pathways of evolution. Provide an example of convergent and another example of divergent pathways of soil genesis **(10 marks)**

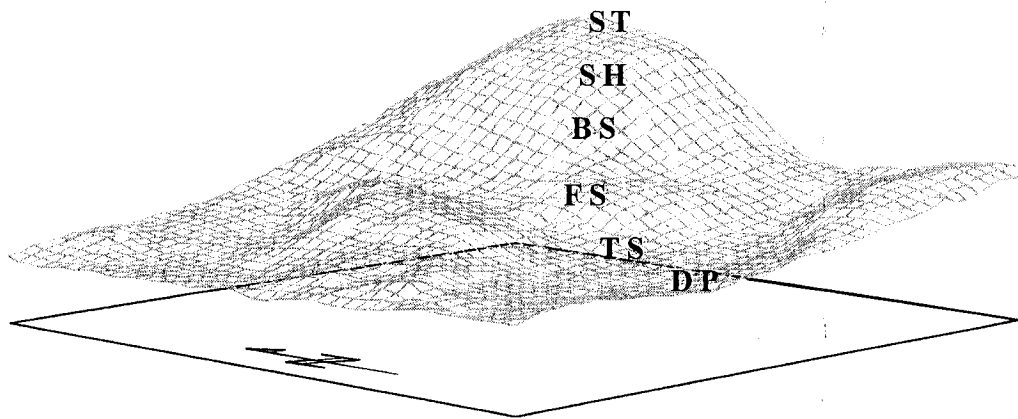
Q3. The USDA Soil taxonomy is one of the most widely used systems of soil classification

- a. What is the role of Soil Taxonomy in agro technology transfer? **(5 marks)**
- b. Explain the difference between the following pairs of taxonomic terms **(6 marks)**
 - Hyperthermic and Isohyperthermic soil temperature regime
 - Frigid and isofrigid soil temperature regime
 - Aridic and xeric soil moisture regime
- c. Among the 12 soil orders recognised in the USDA Soil Taxonomy, Entisols occupy about 16% of the earth’s ice-free land surface, constituting the largest coverage among all soil orders. Why is it so? **(5marks)**
- d. Distinguish between a sub-group and a great group and explain which factors are taken into consideration in identifying the two soil categories in the USDA Soil Taxonomy **(6 marks)**

Q4. Briefly characterise the following soil great groups (USDA Soil Taxonomy) and soil units (FAO) and indicate the most likely diagnostic horizon in each case **(15 marks)**

- a. Eutric Cambisols
- b. Endoaquolls
- c. Acrustox
- d. Cryumbrents
- e. Rhodic Nitisols

Q5. The figure below is a graphic expression of a natural landscape with different topographic positions represented by different letters. Examine it carefully and answer the questions that follow.



- a. In which topographic position/s would you mostly expect to find the following: (Briefly explain your answers) **(10 marks)**
 - i) Very shallow soils, ii) Very old soils, iii) redoximorphic features, iv) Calcium Carbonates near the surface, v) high organic carbon, vi) an Ab horizon, vii) dominance of iron oxides in clay fraction, viii) Plinthite, ix) Saline soils, x) high water percolation
- b. The graphic expression above represents an important soil forming factor. Name that factor and explain why it is considered important in soil formation **(5 marks)**

Q6. A good understanding of epipedons is important for the classification of soils.

- a. What is changing in the following sequence of epipedons? (do not describe the epipedons; just describe the changes) **(8 marks)**

Ochric----Umbric----Mollic----Histic

- b. Explain why an A horizon is not necessarily an Epipedon. **(2 marks)**

Q7. Land evaluation is the process of assessing and predicting the suitability of land for specific uses.

- a. Outline the FAO framework for land evaluation and the basis for its development **(5 marks)**
- b. What are the main weaknesses of the Zambian Land Capability Classification System? **(3marks)**

END OF EXAM

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2012 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION
AN 211 – Human Anatomy I

Instructions:

There are three (3) sections in this examination paper.

Section I consists of 70 multiple choice questions (MCQs), **Section II** consists of 10 short notes questions and **Section III** consists of 3 essay type questions. In **section I** state whether each statement is True or False by indicating **T for True** and **F for False** against each statement.

It is advisable to spend not more than 1 minute on each MCQ, 5 minutes on each short note questions and 20 minutes on each essay type questions.

Time allowed: **Three (3) Hours**

SECTION I: MCQs – Marks 350 (5 points for each question)

1. **Getting definitions right**
 - a. Histopathology studies the arrangement and characteristics of mature normal cell in the tissues
 - b. Cytology can deal with cells in a sputum of a patient with brochogenic carcinoma
 - c. Ileum is a bone of the pelvis
 - d. Ilium is not part of the small bowel
 - e. Chondrocytes might mean small cells in the lungs
2. **Getting definitions right**
 - a. Erythrocytes are cells found in the joints
 - b. Arthrodesis is a type of operation in surgery
 - c. Buccinators are small muscle found in the neck
 - d. Brachialis contracts when lifting one's hand
 - e. Glossitis is an inflammation of the tongue
3. **Getting definitions right**
 - a. Reduction division is observed in the meiosis II
 - b. Spermatogonia cannot propel themselves
 - c. Areolar connective tissues does not resist multidirectional forces
 - d. Allele is a physical location of a gene on a chromosome
 - e. Graafian follicles are different from preantral follicles
4. **Getting definitions right**
 - a. Intermediate filaments provide cellular crawling and pinching
 - b. Nuclear pores allow lysosomes out into the cytoplasm
 - c. Smooth endoplasmic reticulum is called so because of lack of ruggae as compared to rough endoplasmic reticulum
 - d. Epithelial tissue is not part of connective tissue

- e. Ectoderm gives rise to the spinal cord
- 5. Getting definitions right**
 - a. New lutean cells form corpus albicans
 - b. Oviduct fimbriae is the most lateral part of the Fallopian tube
 - c. Oviduct fimbriae is the narrowest part of the fallopian tube
 - d. Corpus luteum graviditadis is seen on the first day of the ovulation
 - e. Human chorionic gonadotropin is secreted by the placenta
- 6. Getting notions right**
 - a. A typical human cell size is 100 μm and 10 ng (nanogramme) in mass
 - b. The longest human cell is found in the bowel
 - c. Both the cytoplasmic and nuclear membranes are phospholipid bilayer membranes
 - d. The plasma membrane serves as an attachment for Glycocalyx
 - e. The phospholipid layer of the plasma membrane has tails as hydrophobic region
- 7. Getting notions right**
 - a. Haploid means a cell that has got pairs of homologous chromosomes
 - b. During the G Phase of the Interphase the DNA replicates to produce two copies of each chromosome
 - c. Mitotic error can cause cancer generating mutations
 - d. Cell divides in cytokinesis
 - e. Identical copy of a single chromosome is also known as chromatid
- 8. Getting notions right**
 - a. Ribosomes are made up of ribonucleoproteins in part
 - b. Ribosomes read the genetic code from tRNA
 - c. A tissue is a group of similar cells with diverse functions
 - d. The uterine cervix is distal to the small intestines
 - e. The body coronal plane bisects through the humerus
- 9. Getting notions right**
 - a. The body ventral cavity includes the vertebral cavity
 - b. The mediastinum constitutes the cephalad part of the abdominal cavity
 - c. The oral cavity is caudal to sinus cavities
 - d. The skin is a parietal serosa
 - e. The heart is covered by the pericardium while the small intestines are covered by the peritoneum
- 10. Getting notions right**
 - a. The stomach is in the epigastric region
 - b. Sonography is an imaging modality that uses X-rays
 - c. Supercilia are eyebrows
 - d. Orchitis is the infection in oral cavity
 - e. Popliteal region is on the posterior part of the knee
- 11. Gametogenesis**
 - a. The physical basis of segregation of allelic genes is by the junction of homologous chromosomes.
 - b. The second meiotic division is preceded not by Interphase unlike meiosis I
 - c. Gastric cells undergo multiple mitotic and meiotic divisions before reaching maturity

- d. Spermatogonia are intermediate stage in the development of spermatozoa
 - e. Secondary spermatocytes are haploid
- 12. Gametogenesis**
- a. Spermatozoa spend more time in the epididymal head than they do in the epididymal tail
 - b. Primary spermatocytes are produced by mitosis
 - c. Spermatids are produced by meiosis I
 - d. Early replenishing of B spermatogonia makes it possible for males to have seamless capacity to produce germ cells
 - e. The acrosome derives from Golgi apparatus
- 13. Gametogenesis**
- a. The germ cells reduce division rate during spermiogenesis
 - b. Spermatozoa separate from the seminiferous tubule basal lamina just before they move to rete testis
 - c. Spermatogenesis last 96 days
 - d. Spermatozoa might be attacked by antibodies of the host because their chromosomal genetic code might differ from the primordial spermatogonia
 - e. The spermatozoal cytoplasmic droplets are shed off in the epididymis
- 14. Gametogenesis**
- a. The spermatogenic DNA polymerase B and recombinase requiring a lower than core body temperature for successful spermatogenesis justifies the testicular topography
 - b. A cryptorchidic man has no problem with erection
 - c. Spermatozoal cytoplasmic droplet hampers the gamete motility
 - d. Oogenesis starts in embryonic life
 - e. In an older pre-puberty girl, the oocytes are found to be in the first meiotic prophase stage
- 15. Gametogenesis**
- a. A mature fertilisable ovum is in the anaphase stage of meiosis
 - b. After ovulation the oocyte is protected by the granulosa membrane
 - c. Because of divisions, a primary oocyte produces four ova at the end of meiosis II
 - d. Female gamete survives longer than the male gamete because of it has all the metabolic factors
 - e. An oocyte can independently complete meiosis II
- 16. Mitosis**
- a. Cytokinesis starts after telophase
 - b. In telophase the nucleus is reconstituted using new membrane building material
 - c. The anaphase is clearly distinct from telophase
 - d. The non-kinetochores microtubules shorten during late anaphase
 - e. Sister chromatids can still separate before all kinetochores are hooked by the microtubules from centrosomes
- 17. Mitosis**
- a. Centrosomes bind sister chromatids together
 - b. Mitotic spindle microtubules enter the nuclear area through the nuclear membrane
 - c. Centrosomes derives from Y chromosome

- d. There are at least two centrosomes in a cell in S phase
 - e. Cohesin protein complex binds centriole pairs
- 18. Connective tissue**
- a. Cells are not in close contact with one another
 - b. Fibroblasts are fixed cells of the cellular component of the connective tissue
 - c. The cartilage is not part of the true connective tissue
 - d. Dense irregular connective tissue is found in liver capsule
 - e. The lymph is also considered to be a connective tissue
- 19. Connective tissue**
- a. The collagenous dense regular connective tissue has relatively poor resistance to linear mechanical stress
 - b. The reticular connective tissue is abundant in the splenic stroma
 - c. Kidneys are surrounded by adipose connective tissue
 - d. Chondroitin sulphate makes the cartilage strong
 - e. Fibrocartilage offers a high flexibility
- 20. Connective tissue**
- a. The epiglottis is mainly made up of hyaline cartilage
 - b. Plasma cells are wandering true connective tissue cells
 - c. Fibroblasts mitosis are rarely seen in the absence of local injury
 - d. Defects in type I collagen synthesis causes osteogenesis imperfecta
 - e. Proteoglycans are not listed among ground substance of extracellular matrix
- 21. Menstrual cycle**
- a. Menstruation can occur after menopause
 - b. In prevent menstruation during pregnancy, the levels of FSH and LH must remain elevated
 - c. Menstruation will occur in regular cycles following the removal of the ovaries as long as the pituitary gland continues to function normally
 - d. All of the above are true
 - e. None of the above is true
- 22. The following cells are haploid**
- a. Ovum
 - b. Spermatogonia
 - c. Primary spermatocytes
 - d. Secondary spermatocytes
 - e. Leydig cells
- 23. After ovulation, the ruptured Graafian follicle**
- a. Produce oestrogen
 - b. Becomes larger than before it ruptures
 - c. Passes into the uterine tube
 - d. Forms a corpus albicans
 - e. Is repaired and eventually forms corpus luteum
- 24. Menopause: menopausal individuals often experience unpleasant symptoms, such as "hot flashes," as a result of:**
- a. An increase gonadotropin concentration and an increase in oestrogen concentration
 - b. An increase in gonadotropin concentration and a decrease in oestrogen concentration

- c. A decrease in gonadotropin concentration and an increase in oestrogen concentration
 - d. decrease in gonadotropin concentration and a decrease in estrogen concentration
 - e. Ill health
- 25. Menstrual cycle: LH is at its highest levels**
- a. Just after the ovulation
 - b. In the last hours of the follicular phase
 - c. Shortly before the ovulation
 - d. Shortly before menstruation
 - e. After ovum fertilisation
- 26. A spermatozoon gross anatomy**
- a. Consists only of a head, a neck and a tail
 - b. Contains 22 autosomes
 - c. Is solely responsible for the sex of a zygote
 - d. Has a great deal of motility as it leaves the testis
 - e. Has an acrosome in the middle piece
- 27. A spermatozoon**
- a. Survives for only 72 hours
 - b. Capacitated in the ejaculatory duct
 - c. Derives its acrosome from the Golgi apparatus
 - d. Mitochondria are concentrated in the head
 - e. Loses its fertilisation potency after 72 hours in female genitalia
- 28. The following are involved in prevention of polyspermy during fertilisation**
- a. Reduction of granulosa cell fluid
 - b. Acrosomal reaction
 - c. Release of lysosomal enzymes by the sperm head
 - d. Release of lysosomal enzymes by oocyte cortical granules
 - e. Zona reaction
- 29. Sperm capacitation involves**
- a. Stripping off cytoplasmic membrane glycoproteins covering the acrosome
 - b. Oviduct epithelial participation
 - c. Loss of caudal portion of the sperm
 - d. Mitochondrial activation
 - e. Acrosin activation
- 30. A pocket formed by an inward folding of a cellular membrane is called**
- a. An invagination
 - b. A membrane receptor
 - c. An inclusion body
 - d. A secretory vesicle
 - e. A vacuole
- 31. Human ovum fertilisation can take place in**
- a. Cervix
 - b. Ovary
 - c. Fallopian tube
 - d. Uterus
 - e. Peritoneal cavity

32. In the last phase of fertilisation

- a. The male and female pronuclei fuse by their membranes
- b. The spermatozoon is propelled by its tail to fuse with the definitive oocyte
- c. The oocyte resumes its meiosis from metaphase II
- d. The definitive oocyte contains 22+X chromosomes while the male pronucleus has 21+XY
- e. The male and female pronuclei are distinguishable by the presence of a tail on the male pronucleus

33. The following are types of endocytosis

- a. Pinocytosis and lysis
- b. Exocytosis and pinocytosis
- c. Lysis and Phagocytosis
- d. Facilitated diffusion and bulk filtration
- e. Pinocytosis and Phagocytosis

34. During the menstrual cycle

- a. The cervical mucus hardly changes
- b. The hormone LH stimulates the production of progesterone by follicles during the menstrual phase
- c. The hormone LH stimulates oestrogen production by follicles
- d. The endometrium thickens in preparation for implantation
- e. FSH stimulates growth of the ovarian follicles

35. Cytosol

- a. Is a viscous, syrup-like fluid component of cytoplasm
- b. Is included in the cytoplasm
- c. Contains carbohydrates and lipids that provide energy for the cell
- d. Has a high water content, with many dissolved solutes
- e. Found in the nucleus

36. Cell organelles

- a. Ribosomes are found in the nucleus, mitochondria, on the rough and smooth endoplasmic reticula
- b. Ribosome assembles twenty-two specific amino acid molecules to form a particular
- c. Ribosomes translate proteins from amino acids using the tRNA template
- d. Ribosomes are synthesised in the endoplasmic reticular system
- e. Ribosome large subunit binds not on tRNA and amino acid

37. Microtubules

- a. Have no role to play in telophase
- b. Participate in interphase
- c. Have largest diameter of the three components of the cytoskeleton
- d. Composed of short chains of the protein tubulin
- e. Associated with organelles movement and cell motility

38. Roles played by smooth endoplasmic reticulum include

- a. Synthesis of cell products & Transport of membrane lipids
- b. Calcium storage
- c. Synthesis of lysosomes
- d. Intercellular signaling

- e. Glucose metabolism
- 39. The rough endoplasmic reticulum functions are**
 - a. Serves as site for protein synthesis
 - b. Synthesis, storage and detoxification
 - c. Protein modification and transport
 - d. Transport, respiration, and synthesis of protein
 - e. Digestion, storage and transport
- 40. The following are examples of applied anatomy**
 - a. Carotid angiogramme
 - b. Measurement of femur length in a fetus using ultrasound
 - c. Identification of the types of cells found in a biopsy sample of lung tissue
 - d. Locating an injury to a tendon in the shoulder using CT imaging
 - e. Describing the process of how a toxin interferes with nerve impulse conduction
- 41. The serous membranes**
 - a. Have a non parietal and visceral layer
 - b. Filled with serous fluid
 - c. Reduce friction between internal organs
 - d. Are the equivalent of cutaneous membranes
 - e. Prevent fluid loss from an organ
- 42. The following are positioned fully ipsilateral to the right hypochondrium**
 - a. Right thigh
 - b. Left iliac region
 - c. Umbilical region
 - d. Genitalia
 - e. Epigastrium
- 43. The following terms are well arranged from the simplest to the most complex structure**
 - a. Organelle; organ; organism; macromolecule; cell; tissue
 - b. Macromolecule; organelle; cell; tissue; organ; organism
 - c. Organism; organ; organelle; tissue; cell; macromolecule
 - d. Cell; macromolecule; organ; tissue; organelle; organism
 - e. Macromolecule; cell; organelle; tissue; organism; organ
- 44. The uterus is located between**
 - a. Urinary bladder and the pubic symphysis
 - b. Rectum and the sacrum
 - c. Rectum and urinary bladder
 - d. Vagina and the Bladder
 - e. Small bowels and vagina
- 45. The female perineum**
 - a. Contains the internal genitalia
 - b. Is divided into two triangles
 - c. Is small than in male
 - d. Can be incised during child birth
 - e. May not tear during childbirth

46. Connective tissue

- a. The Elastin protein is non-existent in the bone matrix
- b. Basement membranes are acellular
- c. Ground substances are laid down by connective tissue cells
- d. All fibrocytes are fibroblasts but not all fibroblasts are fibrocytes
- e. Some food consumption might trigger mast cells degranulation

47. In epithelial tissue

- a. Stratified cuboidal epithelium might be in breast alveoli
- b. Transitional epithelium is found in the respiratory system
- c. Few red blood cells are found interspaced with epithelial cells
- d. Epithelial tissue is known for its poor sensory
- e. Stratified epithelium is well equipped and convenient for filtration role

48. Connective tissue

- a. Macrophages are transient resident cells in the connective tissue
- b. Fibroblasts move freely in and out of connective tissue
- c. Plasma cells differentiate into macrophages that secrete antibodies.
- d. Mast cells release chemotactic substances when degranulating
- e. Collagen is the least abundant of the connective tissue fibres

49. Epithelia

- a. Made up of densely held together cells
- b. Rarely found inside alveolar and muscular tissues
- c. Absorption of substances is done on the apical aspect of an epithelium
- d. The reticular lamina is closer to the epithelial surface and secreted by the epithelial cells
- e. There is a high mitotic activity in the epithelial cells

50. Embryological origin of tissues

- a. Connective tissue derives from ectoderm
- b. The upper layers of the skin develop from ectoderm
- c. The tongue moving muscles arise from mesoderm
- d. The spinal cord derives from endoderm
- e. Lymph nodes arise from mesoderm

51. The tissue shed off during menstruation is

- a. Endocervix
- b. Basalis endometrium
- c. Myometrium
- d. Functional endometrium
- e. Tunica vaginalis

52. Ribosomes are most abundant in

- a. Hair cells
- b. Tendons
- c. Liver
- d. Skin
- e. B and C

53. The following statements are correct

- a. Each oogonium beginning oogenesis produces four mature ova

- b. Spermatogonia and oogonia both continue to divide throughout a person's lifetime to produce new primary spermatocytes and primary oocytes
 - c. Spermatogonia continue meiotic division indefinitely.
 - d. The menstrual cycle refers to a series of changes in the uterus, whereas the ovarian cycle is a series of changes in the ovary
 - e. Meiosis is a part of both oogenesis and spermatogenesis
- 54. In a woman, the best description of when ovulation occurs is**
- a. 14 days before the end of menstruation
 - b. Exactly midway between menstrual cycles
 - c. 14 days after the beginning of menstruation
 - d. 14 days after the end of menstruation
 - e. 14 days before the beginning of menstruation
- 55. Menstruation is initiated by a serum concentration decline in**
- a. Prolactin and progesterone
 - b. Oestrogen and Prolactin
 - c. Progesterone and androgen
 - d. Progesterone and oestrogen
 - e. Androgen and LH
- 56. Urethra**
- a. External urethral sphincter prevents retrograde ejaculation
 - b. The female urethra is four times shorter than the male urethra
 - c. The spongy urethra is shorter than the membranous urethra
 - d. The bulbourethral ducts open into the spongy urethra
 - e. Opens into the vagina
- 57. The following statements are false**
- a. Menstruation is triggered by a sudden increase in the secretion of luteinizing hormone
 - b. Hysterectomy (removal of the uterus) stops ovulation
 - c. In order to prevent menstruation during pregnancy, the levels of FSH and LH must remain elevated
 - d. Menstruation will occur in regular cycles following the removal of the ovaries as long as the pituitary gland continues to function normally
 - e. Menopause can occur in early thirties
- 58. The following structures in a male and in female have different embryonic origin**
- a. Penis and clitoris
 - b. Utricle and uterus
 - c. Prostate and Skene's glands
 - d. Cowper's gland and Bartholin's gland
 - e. Prepuce and clitoris hood
- 59. Concerning the seminal vesicles, these statements are true**
- a. They are located on the posterior surface of urinary bladder
 - b. They secrete prostaglandins
 - c. They pass their contents into the vas deferens
 - d. Their secretion contains fructose
 - e. They are located lateral to the vas deferens
- 60. Regarding ovulation, the following statements are false**
- a. It occurs at the end of each menstrual cycle
 - b. It begins at puberty and usually ends after birth of the last born baby
 - c. It happens in all females of reproductive age not using hormonal contraception
 - d. Follow 38 hours of the LH surge
 - e. It is the process of gamete formation in a female

61. **Regarding function of fructose in semen, the following is false**
 - a. It promotes coagulation of semen in the female reproductive tract
 - b. It buffers acids in the female reproductive tract
 - c. It provides an energy source for ATP production by sperm
 - d. It makes the sperm enjoyable the recipient female
 - e. It inhibits the growth of bacteria in semen and the female reproductive tract
62. **By their products, the following structures do not contribute to the composition of the semen**
 - a. Seminiferous tubules
 - b. Bulbourethral glands
 - c. Prostate
 - d. Seminal vesicles
 - e. Vas deferens
63. **For the spermatic cord, the following assertions are untrue**
 - a. Doesn't develop until puberty
 - b. Is the same as the vas deferens
 - c. Carries only sperm
 - d. Is found in the inguinal canal of the male
 - e. Holds the lower end of testes to the scrotum
64. **Naming the vertical plain through the body that divides it into right and left, the following terms are terms are wrong**
 - a. Sagittal
 - b. Coronal
 - c. Transverse
 - d. Frontal
 - e. Median
65. **The following are false about the visceral pleura**
 - a. It not sensitive to pain
 - b. It is the membrane lining surface of the lungs
 - c. It is the membrane lining the wall of the thoracic cavity
 - d. It is the fluid around the lungs
 - e. It is the thinnest portion of the peritoneum
66. **After ovulation, the ruptured Graafian follicle**
 - a. Produces progesterone
 - b. Forms a corpus albicans
 - c. Passes into the uterine tube
 - d. Is repaired and eventually forms corpus luteum
 - e. Becomes larger than before its rupture
67. **The following are not structures responsible for regulating the testicular temperature**
 - a. Cremaster muscle
 - b. Spermatic cord
 - c. Gubernaculum
 - d. Tunica albuginea
 - e. Dartos muscle
68. **The process of crossing-over, or recombination, of genes occurs during**
 - a. Meiosis II
 - b. Mitosis
 - c. Spermiation
 - d. Meiosis I
 - e. Oocytogenesis

69. This is true about oestrogens

- a. Their reduction in the post menopause is responsible for poor bone mineralisation, hence the high incidence of bone fractures.
- b. They are secreted by the corpus luteum
- c. They decrease in amounts during the follicular phase
- d. They are secreted in large amounts during pregnancy
- e. They are responsible for growth of the endometrium during early phase of menstruation

70. During spermatogenesis, the cells formed as a result of the second meiotic division are

- a. 4 secondary spermatocytes
- b. 4 spermatids
- c. 4 spermatogonia
- d. 2 primary spermatocytes
- e. 2 primary spermatocytes

SECTION B: Short Notes Marks: 350 (35points for each question)

Write short notes on the following

1. Clinical disorders resulting from collagen synthesis defects
2. Ground substance of extracellular matrix
3. Fibres in connective tissue
4. Classify in strata and substrata the human (animal) tissues
5. Cells in connective tissue
6. Mechanisms that help maintain a lower testicular temperature than the core body temperature
7. Spermatozoa capacitation
8. Uterine cycle
9. Body cavities
10. Mitosis

SECTION C: Essays. Marks:300 (100 points for each essay)

1. Describe the full meiosis in male gametogenesis
2. Describe proper or true connective tissues
3. Illustrate the ovulation cycle
4. Describe the epithelial tissue

END

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

2012 ACADEMIC YEAR FIRST SEMESTER FINAL EXAMINATION

PGY ³¹⁸~~221~~ - MEDICAL PHYSIOLOGY

TIME: THREE (3) HOURS

INSTRUCTIONS

- i. Please read all the instructions and each question carefully
 - ii. All questions carry equal marks
 - iii. Answer any **FIVE (5)** questions only
-

1. Write short notes on each of the following:
 - a. Respiratory acidosis
 - b. Respiratory alkalosis
 - c. Skeletal muscle
 - d. Smooth muscle
 - e. The Golgi apparatus
 2. Describe internal and external respiration in terms of partial pressures of oxygen and carbon dioxide.
 3. Explain the factors that affect the Basal Metabolic Rate of man.
 4. Discuss the digestion and subsequent absorption of fats.
 5. A normal systemic blood pressure is essential to life. Explain in detail the mechanisms that the body uses to maintain the systemic blood pressure at normal levels.
 6. Answer the following questions on fluid electrolyte balance
 - a. Name the major water compartments and the name for water in each of them.
 - b. Name three specialised body fluids and state the location of each.
 - c. Name the processes by which water moves between body fluid compartments.
 - d. Describe how the body regulates water intake and output.
 7. Discuss the structure and functions of the following:
 - a. Plasma membrane
 - b. Endoplasmic reticulum
-

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

2011 ACADEMIC YEAR FIRST SEMESTER

M. A. FINAL EXAMINATIONS

PHL5051: THEORETICAL APPROACHES TO ENVIRONMENTAL ETHICS

TIME: THREE HOURS

ANSWER: ANY FOUR OF THE FOLLOWING SIX QUESTIONS

1. (a) "Gaia theory looks upon planet Earth as a living system that has emerged from an evolutionary cosmos." Discuss critically the meaning of this statement.
(b) Discuss critically whether planet Earth can properly be referred to as a mechanism or an organism.
2. (a) Arne Naess speaks of human maturation being found in Self-realisation through identification with planet Earth. Explain what he means by this and discuss critically whether his approach is realistic.
(b) Deep Ecology has been criticised for being too ego-centric and too spiritual in its approach. Discuss critically whether you think this criticism is justified.
3. (a) Explain and discuss critically Leopold's land ecosystem ethic.
(b) Leopold has been accused of undervaluing the unique place of humans in the ecosystem. Explain whether you think this criticism is valid.
4. (a) In his focus on "speciesism", Peter Singer believes that there should be no species barrier between higher animals and humans. Explain and discuss critically whether you think his position is justified.
(b) Discuss critically whether individual organisms or species are entitled to rights. Explain your answer.
5. (a) In his theory of Social Ecology, Murray Bookchin believes that inequalities in social structure are the basic cause of environmental degradation. Explain and discuss critically.
(b) Identify some of the differences between social ecology and deep ecology.
6. (a) Ecofeminism links the unequal treatment of women by men to degradation of the natural environment. Explain what is meant by this and whether you think it is justified.
(b) Compare and contrast the theory of ecofeminism with that of social ecology.

END OF EXAMINATION