THE UNIVERSITY OF ZAMBIA

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THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

2017/18 ACADEMIC YEAR UNIVERSITY EXAMINATIONS

TERM 1, JULY 2018

AEN 4131: FARM STRUCTURES

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS:

1. THIS EXAMINATION PAPER HAS **SIX (6)** QUESTIONS.
2. ANSWER ANY **FIVE (5)** QUESTIONS.
3. ALL QUESTIONS CARRY **EQUAL MARKS** (20 MARKS EACH).
4. THE MARKS FOR EACH SUB-QUESTION ARE GIVEN IN BRACKETS.

QUESTION 1

a) List any **four (4)** factors that should be considered when choosing a preservative.

[4 marks]

b) Briefly discuss how timber is used in the following situations, giving examples of specific applications, the form in which timber is used and indicate the basic requirements of the timber under each application.

i) Constructional work;

[4 marks]

ii) False work carpentry; and

[4 marks]

iii) Finishing joinery

[4 marks]

c) State two advantages and two disadvantages of **thatch** as a roofing material for buildings in rural areas.

[4 marks]

QUESTION 2

a) Briefly explain the following terms with respect to fresh concrete:

i) Workability

[4 marks]

ii) Stability

[4 marks]

(b) Given that a concrete mix has a cement:sand:stone ratio of 1:3:5 by volume using naturally moist aggregates and that 2 bags of cement (each weighing 50kg) and 62 litres of water are used in the mix. Calculate:

i) The volume of ingredients

[3 marks]

ii) The water to cement ratio by weight

[3 marks]

iii) The solid volume of the concrete, excluding air voids in the materials.

[3 marks]

iv) The reduction in volume between the mixture and the sum of the separate volumes of ingredients.

[3 marks]

Additional information:
Moisture content of sand: 4%
Moisture content of stones: 1.5%
Bulk density of the cement: 1351 kg/m³
Bulk density of the sand: 1400 kg/m³
Bulk density of the stones: 1600 kg/m³
Solid density of aggregate materials: 2650 kg/m³
Solid density of cement: 3100 kg

QUESTION 3

a) A farmer is using a simply supported beam to hoist an engine weighing 6 kN from a tractor. The simplified beam and hoist arrangement is shown in Figure 3 below.

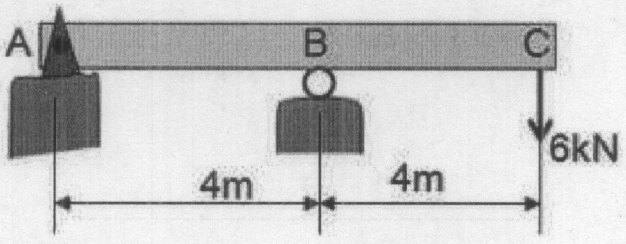


Figure 3

i) Determine the supporting reactions on the beam points A and B.

[6 marks]

ii) Draw the shear force and bending moment diagrams for the beam.

[10 marks]

iii) State the location and the maximum value of the shear force and the bending moment.

[4 marks]

QUESTION 4

a) An effective zone plan for a new farmstead has been sketched as shown in figure 4. Briefly explain the nature of the function and / or activity expected in the concentric circle zones labelled I, II, III, and IV.

[12 marks]

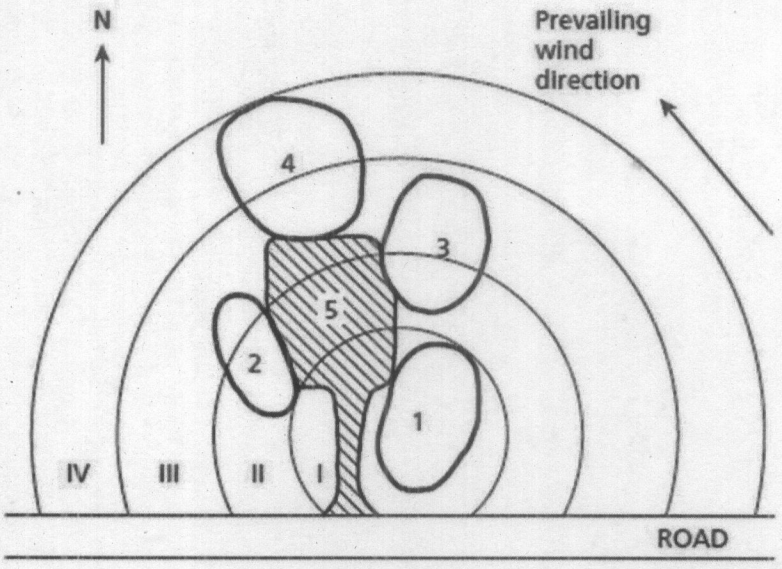


Fig. 4: Zonal planning of a new farmstead.

b) When choosing a site for farm buildings, several factors must be taken into account. Outline any **four (4)** of these factors.

[8 marks]

QUESTION 5

a) A pig production unit has 80 sows in which the average suckling period is 8 weeks. Piglets remain in the farrowing pens for 4 weeks after weaning and 1 week is required for cleaning and sanitation before farrowing. The average weaning to conception period is 20 days, while the gestation period is 114 days. The sows are moved to the farrowing pens 1 week before farrowing, but 7 days must be added for cleaning the servicing/gestation pens.

Two-stage growing and finishing is practised with growing pigs remaining in the growing pen from 12 to 20 weeks of age and in the finishing pen from 20 to 27 weeks of age. One week is required in the growing pen for cleaning and sanitation. Two weeks are required for selling off the finished pigs and 1 week for cleaning the finishing pen. Assume that 8 piglets survive to finishing, determine:

i) the number of farrowing's per year.

[5 marks]

ii) the number of farrowing pens.

[5 marks]

iii) the number of servicing/gestation pens each housing **5** sows.

[5 marks]

iv) the number of boar pens if each boar services **16** sows.

[5 marks]

QUESTION 6

a) All farm buildings are designed to perform specific functions. List any **five (5)** of these functions.

[5 marks]

b) State any **four (4)** functions of ventilation in buildings.

[4 marks]

c) A poultry building houses 2,000 broilers. The sensible heat production at ambient temperature is approximately 8.4 W/bird and the moisture production is 6 g/hour per bird. The building has an average AU value of 0.34 kW/K. The outside temperature is 15°C at a relative humidity of 70%, while the desired internal conditions must be maintained at a temperature of 25°C and a relative humidity of 75%. Six 100 W light bulbs are on in the building all the time for lighting. The latent heat of water vaporisation is 2454 kJ/kg, while the specific heat capacity of air is 1.005 kJ/kg°C. Use the psychrometric chart for 1500m above sea level to find:

i) the total heat gain in the building assuming that all moisture produced by the birds can evaporate.

[5 marks]

ii) the minimum ventilation rate required to maintain the desired relative humidity.

[2 marks]

d) Explain the function of grain storage in the economy?

[4 marks]

**********************END OF EXAMINATION*********************

LIST OF EQUATIONS

$Q = EAV$ $Q = VA$ $V = \varphi\,[(2gh\,(T_i - T_o/T_i)]^{1/2}$

$q_s + q_e + q_{sup} \pm q_l - q_B = q_{vi} - q_{vo}$ $q_v = q_s + q_{sup} - q_w - q_b\; q_v = q_s - q_b$

$q_l = MNh_{fg}$ $mC_p\Delta T = q_s - \sum AU\Delta T$ $MN + mW_o = mW_i$

$m(h_i - h_{tp}) = q_l q_v = mCp\Delta T$ $q_B = \sum AU\Delta T$

Carrier

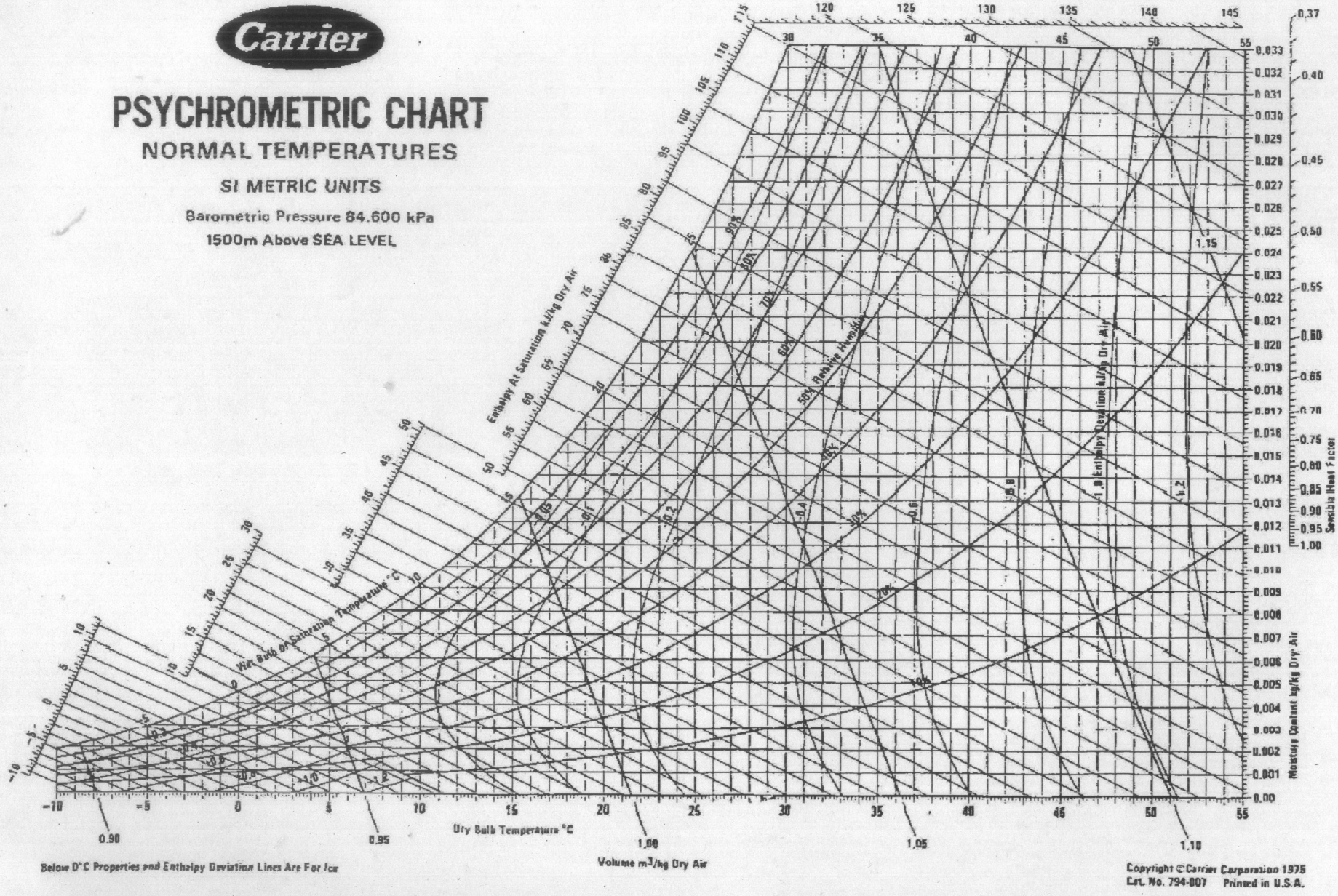
PSYCHROMETRIC CHART

NORMAL TEMPERATURES

SI METRIC UNITS

Barometric Pressure 84.600 kPa

1500m Above SEA LEVEL



Below 0°C Properties and Enthalpy Deviation Lines Are For Ice

Cat. No. 794-007 Printed in U.S.A.

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

AGA 2110 ANATOMY AND PHYSIOLOGY OF FARM ANIMALS

FINAL EXAMINATION- NOVEMBER 2019

INSTRUCTIONS:

- ANSWER **ANY FIVE (05) QUESTIONS**
- ANSWER **EACH SECTION** IN A **SEPARATE** ANSWER BOOKLET
- **CLEARLY WRITE THE NUMBER** OF EACH ATTEMPTED QUESTION
- **START** EACH QUESTION ON A **NEW PAGE**
- ALL QUESTIONS CARRY EQUAL MARKS (**20 MARKS**).

SECTION A

QUESTION ONE

A. Write short notes on the following terms as they are used in farm animals;
(a) Epididymis **(2 Marks)**
(b) Number and position of mammary glands in sheep and cattle **(2 Marks)**
(c) Physiological buffers **(2 Marks)**
(d) Acrosome **(2 Marks)**
(e) Ovum **(2 Marks)**

B. Briefly explain the following phenomena;
(a) Alveoli **(2 Marks)**
(b) Formed elements of blood **(5 Marks)**
(c) Keratinocyte **(1 Marks)**
(d) Hormone **(1 Marks)**
(e) Blood testis barrier **(1 Marks)**

QUESTION TWO

(a) State four functions of the circulatory system. **(4 Marks)**
(b) Briefly explain the gross anatomical sections of lungs as seen in the bovine **(6 Marks)**
(c) Draw and clearly label the main features of a spermatozoon **(8 Marks)**
(d) Name two structures associated with the integument? What role do these structures play? **(2 Marks)**

QUESTION THREE

With regard to farm animals,

i. State the role of any ten endocrine glands **(10 Marks)**
ii. Describe two mechanisms for thermoregulation in the integument **(4 Marks)**
iii. What is the role of melanocytes? **(2 Marks)**
iv. In relation to heat loss or gain heat, what do the subscripts E, R, C, & G in the equation $M - E_E \pm E_R \pm E_C \pm E_G \pm S = 0$ represent? **(4 Marks)**

SECTION B

QUESTION ONE

A. State the four (04) types of tissue found in an animal's body and mention one general role for each of the tissues **(4 Marks)**

B. For each of the following four joints, state where these are found in a farm animal **(4 Marks)**
- Fetlock, Pastern, Coffin, and Suture

C. Farm animals are categorised into 3 groups based on the anatomy of the digestive system.
i. Mention the 3 groups or categories **(3 Marks)**
ii. Explain the anatomical differences in the gastrointestinal track and list one species that belongs to each category **(6 Marks)**
iii. Explain how the anatomy is related to the diet of the animals **(3 Marks)**

QUESTION TWO

A. What is a blood brain barrier (BBB)? Outline the basic structure of the BBB and mention two (02) roles performed by the blood brain barrier in the body. **(6 Marks)**
B. Briefly outline the three (03) basic functions of the nervous system. **(3 Marks)**
C. What two (02) basic cell types make up the nervous tissue and what are their specific roles? **(4 Marks)**
D. An animal's body has four (4) types of bones based on gross appearance. Mention the four types and for each category mention one bone that belongs to this category. **(4 Marks)**
E. Mention three (3) types of cells found in bone tissue and state the function of each cell type **(3 marks)**

QUESTION THREE

A. A sarcomere is a basic contractile unit of a skeletal muscle made of 2 proteins filaments.
i. What are the 2 protein filaments? **(2 Marks)**
ii. With the aid of a simple sketch, describe how the protein filaments are arranged in a sarcomere and indicate the different regions or parts. **(6 Marks)**
iii. Explain the changes that occur to the different regions during muscle contraction. **(2 Marks)**

B. Briefly describe the connective tissue wrappings of skeletal muscle and give an indication of their relative location **(6 Marks)**
C. Differentiate between the following terms
i. Tissue and organ **(2 marks)**
ii. Cilia and flagella **(2 Marks)**

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

AGA 2110 ANATOMY AND PHYSIOLOGY OF FARM ANIMALS

FINAL EXAMINATION- DECEMBER 2020

INSTRUCTIONS:

- ANSWER **ANY THREE QUESTIONS**
- ANSWER **EACH SECTION** IN A **SEPARATE** ANSWER BOOKLET
- **CLEARLY WRITE THE NUMBER** OF EACH ATTEMPTED QUESTION
- **START** EACH QUESTION ON A **NEW PAGE**
- ALL QUESTIONS CARRY EQUAL MARKS (20 MARKS).

SECTION A

QUESTION ONE

A. Write short notes on the following terms as they are used in farm animals;

i. Anastomoses **(2 Marks)**
ii. Serum **(2 Marks)**
iii. ECF **(2 Marks)**
iv. Pampiniform plexus **(2 Marks)**
v. Alveoli **(2 Marks)**

B. Briefly discuss the following phenomena;

i. Lobes of the bovine lung **(3 Marks)**
ii. Anatomical components of the mammary gland **(6 Marks)**
iii. Preen gland **(1 Marks)**

QUESTION TWO

With regard to farm animals;

A. State four (4) functions of the integumentary system. **(4 Marks)**
B. Use a diagram to show the gross anatomical bovine female reproductive system **(6 Marks)**
C. Draw and clearly label the main features of a graafian follicle **(8 Marks)**
D. What constitutes a portal circulation? **(2 Marks)**

SECTION B

QUESTION ONE

A. Based on the anatomy of the digestive system, farm animals are categorised into four (04) groups.

i. Mention the four (04) groups or categories **(2 Marks)**
ii. Explain the anatomical differences in the gastrointestinal track and list one species that belongs to each category **(8 Marks)**

B. Based on the method of secretion, exocrine glands are categorised into 3 groups.

i. Define exocrine glands **(1 mark)**
ii. Mention the three (03) categories of exocrine glands **(3 marks)**
iii. Differentiate the three categories **(3 marks)**
iv. For each of the categories, mention one gland that belongs to it **(3 marks)**

QUESTION TWO

A. State the three (03) basic functions of the nervous system. **(3 marks)**

B. List any five (05) general functions of the skeletal system **(5 marks)**

C. Based on their gross appearance, an animal's body has four (4) types of bones.

i. Mention the four types of bones **(2 marks)**
ii. For each category mention one bone that belongs to that category **(2 marks)**

D. For each of the following, what is the;

i. Functional difference between a neuron and neuroglial cells **(2 marks)**
ii. Anatomical difference in location of parietal and visceral pleural **(2 marks)**
iii. Structural difference between flagella and cilia **(2 marks)**
iv. Anatomical difference in the location of serous and mucous membranes **(2 marks)**

END OF EXAMINATION
BONNE CHANCE **** GOOD LUCK

UNIVERSITY OF ZAMBIA
SCHOLL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

AGA 3201- PRINCIPLES OF ANIMAL NUTRITION
MIDYEAR EXAM
10 JULY 2018

INSTRUCTIONS TO CANDIDATES

Answer any **FIVE** (05) questions. Answer each section in a separate answer booklet

TIME ALLOWED: 3 HOURS

SECTION A

1. Glucose is the main substrate for the glycolytic pathway. Mention four (04) other substrates that are metabolized through glycolysis and explain how each of these metabolites are mobilized to enter the sequence (8 Marks)?

   B). What are the main products of the phosphogluconate or the hexose monophosphate pathway and what is the importance of each product as far as metabolism of the organism is concerned (6 Marks)?

   C). Explain the importance of transketolase and transaldolase reactions in the interconversion of pentose and hexose sugars (6 Marks).

2. A). Explain the digestion of lipids in non-ruminants and how the end products of this digestion are mobilized for utilization or storage in the host animal (8 Marks)?

   B). Explain the process of ß-oxidation of fatty acids in the metabolism of storage fatty acids in an effort to generate energy. How is the energy conserved in reduced co-enzymes mobilized to produce ATP (12 Marks)?

3. Explain how excess nitrogen is removed from animal bodies through the urea cycle and what is the linkage between the tri-carboxylic acid cycle (TCA) and the urea cycle (12 Marks)?

   B). How are the amino acids utilized in farm animals after being absorbed from the gastro intestinal tract (8 Marks)?

SECTION B

1. A) What are the sources of carbohydrates for the ruminant animal (4 Marks)

   B) Discuss in detail carbohydrate digestion in the rumen and explain how are the products of digestion are utilized by the host animal. (16 Marks)

2. A) Discuss four (04) important factors that influence Metabolisable energy content of animal feeds. (8 Marks).

   B) Explain how environmental temperatures influence metabolic rates in endotherms (warm blooded animals) (4 Marks)

   C) Define basal metabolic rate (BMR) and discuss any three (03) factors that influence it? (8 Marks)

3. Write short notes on the following (4 Marks each)

   A) Biochemistry of events that occur in ketosis

   B) Common properties of fat soluble vitamins

   C) Role and mode of action of the parathyroid hormone in an animal's body.

   D) Four (04) antinutritional factors found in soyabeans and the mode of action for each of them.

   E) Substantiate the statement. ''In ruminant animals, the type of feed influences the ruminal microbial population, the rate of digestion and the dry matter intake''

The University of Zambia
School of Agricultural Sciences
Department of Animal Science
2020 END OF THE YEAR DEFERRED EXAMINATIONS

AGA 3201: PRINCIPLES OF ANIMAL NUTRITION

Answer **any three** questions from the five provided, but at least one question from each section.
Write your answers for **EACH** section in a **SEPARATE** answer booklet
All question carry equal marks **(20 Marks each)**

SECTION A

QUESTION ONE

Carbohydrates are complex molecules that consists of three basic elements; Carbon, Hydrogen and Oxygen.

(i) Describe at least four functions of carbohydrates in an animal's body **(4 Marks)**

(ii) Among the carbohydrate monomers you are familiar with, draw the ring structure of one of them **(2 Marks)**

(iii) Describe how carbohydrates are digested at different stages in a monogastric animals, mentioning at each stage the enzymes involved, the bonds broken, and the products yielded **(10 Marks)**

(iv) At each stage of carbohydrates digestion, what are the hormones involved in their digestion and which organs produce them? **(4 Marks)**

QUESTION TWO

(i) Write down the general formula for any amino acid, and identify the functional groups in this molecule **(3 Marks)**

(ii) With at least four reasons, explain the importance of proteins in the diets of farm animals **(8 Marks)**

(iii) Describe each of the following classes of amino acids, and give an example of an amino acid under each class:

a. Basic **(2 Marks)**

b. Neutral **(2 Marks)**

c. acidic **(2 Marks)**

(iv) Explain the meaning of each of the following terms used when describing amino acids:

a. Amphoteric amino acids **(1 Mark)**

b. Primary structure of an amino acid **(1 Mark)**

c. isoelectric point **(1 Mark)**

SECTION B

QUESTION THREE

A. Discuss five (05) general factors that regulate feed intake in farm animals **(10 Marks)**

B. With the aid of a diagram, explain how feed energy is partitioned in an animal's body indicating the losses that occur along the way **(10 Marks)**

QUESTION FOUR

A. What are the main sources of carbohydrates for ruminants? Give one example for each source mentioned **(2 Marks)**

B. Explain in detail the digestion and metabolism of carbohydrates in the rumen mentioning the enzymes involved and the important biochemical pathways. **(12 Marks)**

C. What are the end products of rumen carbohydrate fermentation? How is each of the products utilized by the ruminant **(6 Marks)**.

SECTION C

QUESTION FIVE

A). Apart from glucose, mention at least five (5) alternative substrates for glycolysis and explain how each one of them is mobilised for entry into the sequence? (**10 Marks**).

B). What are the key products of the TCA cycle and how are these products utilized by the host animal? (**10 Marks**)

- THE END -

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

AGA 3201- PRINCIPLES OF ANIMAL NUTRITION FINAL EXAMINATION

INSTRUCTIONS:

1. There are **THREE SECTIONS** in this paper
2. Answer **ONE** (01) question from **EACH** section
3. Use a separate answer booklet for each section

SECTION A

QUESTION ONE

(a) Glucose, fructose and amino acids are the end products of digestion of carbohydrate and proteins The molecular formula of these monomers can be projected in two ways, linear or cyclic forms Draw their molecular formulae, identifying and naming the functional groups that distinguish them **(9 Marks)**

(b) With an aid of a diagram, explain the mechanisms through which glucose and fructose monomers are absorbed into the portal vein. Show the depth of your knowledge in nutrient absorption mechanisms by mentioning the membrane protein carriers that facilitate their transportation across the membrane of the enterocyte **(11 Marks)**

QUESTION TWO

(a) In brief, describe the roles played by each of the following in the digestion of proteins in a monogastric animal

- **(i)** Hydrochloric acid **(4 Marks)**
- **(ii)** Secretin **(4 Marks)**
- **(iii)** Cholecystokinin (CCK) **(4 Marks)**
- **(iv)** Carboxypeptidase **(4 Marks)**

(b) Differentiate each of the following types of lipids;

- **(i)** Trans-fatty acids and Cis-fatty acids **(2 Marks)**
- **(ii)** Saturated and unsaturated fatty acids **(2 Marks)**

SECTION B

QUESTION THREE

A). What are the main sources of carbohydrates for the ruminant animal? Give one example for each source **(4 Marks)**

B). Explain in detail the fermentation of carbohydrates in the rumen. **(10 Marks)**

C). What are the end products of rumen carbohydrate fermentation and how are they metabolized and utilized by the ruminant animal **(6 Marks)**

QUESTION FOUR

A). Discuss five (05) major factors that regulate feed intake in animals **(10 Marks)**

B). with the aid of a sketch, explain how food energy is partitioned and utilized in an animal's body indicating the losses that occur in the process of utilization **(10 Marks)**

SECTION C

QUESTION FIVE

A). List the functions of dietary amino acids in animal tissues and explain why some amino acids are termed as essential while others are not? **(8 Marks)**

B). What are the main products of the tri-carboxylic acid cycle and how are these products utilized by the host animal? **(12 marks)**

QUESTION SIX

A). What are the reactions of beta-oxidation and what is the likely fate of the generated acetyl coenzyme A generated from the same reaction? **(12 Marks)**

B). What are ketone bodies and how are they generated and metabolized for removal from animal tissues? **(4 Marks)**

C). What is transamination and why is it important as far as metabolism of proteins is concerned?

(4 Marks)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIERNCES
DEPARTMENT OF ANIMAL SCIENCE
20202 END OF THE YEAR FINAL DEFFERED EXAMINATIONS
AGA 3212 – APPLIED ANIMAL NUTRITION

INSTRUCTIONS

Answer any three questions from the five provided, but at least one question from each section.
Write your answers for each section in a different answer booklet
All question carry equal marks (20 Marks each)

SECTION A - FEED INGREDIENTS CLASSIFICATION

Q1.

(a) Hay and silage are preserved roughages for livestock feeding. For each of these preserved roughages:

i. Briefly describe the processing methods used in their preservation. **(6 marks)**

ii. Explain the effects that the preservation processes have on the feeding characteristics and nutritive value of the roughage. **(8 marks)**

(b) Mineral supplements may be added to livestock rations to supplement specific mineral deficiencies.

i. List any three (3) minerals that are most likely to be deficient in livestock rations, therefore, requiring dietary supplementation. **(3 marks)**

ii. For each mineral listed in 1bi) give one source that is used as a supplement for the mentioned mineral in livestock feed. **(3 marks)**

Q2.

Briefly describe the differences in feeding/nutritional characteristics of the following feed ingredients:

i. 'High-tannin sorghum' and 'Low-tannin' sorghum. **(5 marks)**

ii. 'Full-fat' soybean meal, 'Oil-extracted' soybean meal and 'Mechanically-extracted' soybean meal. **(10 marks)**

iii. 'Meat meal' and 'Meat and Bone' meal **(5 marks)**

SECTION B – RATION FORMULATION FOR MONOGASTRIC ANIMALS

Q3.

To reduce the cost of feeding broilers, some farmers prefer to use Concentrates during the growing and finishing phase of the rearing period. Using soybean meal (SBM), DCP, Limestone flour, salt, Vitamin premix, and Trace minerals premix, you are requested to formulate a 100 Kg concentrate for broiler finisher ration to be mixed with 300kg of maize to make a complete diet with 18% CP, 1.0% Ca, 0.65% P, 0.35% Salt, 0.1% trace minerals and 1.0% vitamin premix (20 Marks). Use maize as a carrier, and assume that salt, vitamin premix, and trace mineral premix do not contain CP, Ca or P. The composition of the other ingredients is as shown in Table 1:

Table 1: Nutrient composition of various ingredients

INGREDIENT	CP%	Ca%	P%
Maize	8.8	0.03	0.27
Soybean meal	50.9	0.26	0.62
DCP	0	23.35	18.21
Limestone flour	0	35.8	0

Q4

(A) As a new University of Zambia graduate, specialized in monogastric animal nutrition, you are asked by a local farmer in your area to formulate a broiler starter ration with 22% CP, 1% Ca and 0.65% P using ingredients shown in Table 2. If the wheat bran is to be fixed at 5%, fish meal at 10%, salt and premix at 0.5% each, while the Amprolium at 0.1%, how much of each ingredients listed in the table below will be required to make this ration? **(17 Marks)**

Table 2: Proximate composition of various ingredients

Ingredient	Protein %	Calcium (%)	Phosphorus (%)
Maize	8.8	0.05	0.27
Wheat bran	15.4	0.13	1.13
Full fat -SBM	38.9	0.26	0.61
Fish meal	70.1	2.19	1.67
DCP	0	24.0	18.21
Limestone flour	0	37.11	0
Salt	0	0	0
Broiler premix	0	0	0
Amprolium	0	0	0

(B) Show proof that the feed contains 22% CP, 1% Ca and 0.65% P **(3 Marks)**

SECTION C – RATION FORMULATION FOR RUMINANT ANIMALS

Q5.

A). Explain all the steps you need to undertake in order for you to adequately select feed ingredient for animals to be used in ration formulation in a given location (8 Marks)?

B). Assume you have a 350kg Jersey dairy cow that is producing milk with 3.5% butter fat and the animal depends on natural grass that contains 32% Dry Matter and energy and protein concentrations of 650g total digestible nutrients (TDN) and 90g digestible crude protein (dCP) per kg dry matter. If the cow consumes 2.7% of its body weight, how much of this natural pasture is this animal expected to eat each day on as fed basis? What are the energy (TDN) and digestible crude protein (dCP) concentrations in the natural pasture when expressed on as fed basis? How much milk per day is this animal expected to produce by consuming the allocated natural pasture? The nutrient requirements for the cow are as tabulated in Table 3 (12 Marks).

Table 3: Nutrient requirements for maintenance and milk production in dairy cows

Maintenance requirements per day			Milk production requirements per litre		
Weight (kg)	TDN (g)	dCP (g)	Butter fat (%)	TDN (g)	dCP (g)
350	3400	270	3.5	415	51
400	3700	290	4.0	470	56
450	4300	310	4.5	530	63

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

AGA 3335 PRINCIPLES OF ANIMAL PRODUCTION FINAL EXAMINATION-2018

INSTRUCTIONS:

- ANSWER **ANY FIVE (5)** QUESTIONS FROM THE SIX PROVIDED IN **SECTIONS A. AND B.**
- EACH **SECTION** SHOULD BE ANSWERED IN A **SEPARATE BOOKLET**
- **WRITE THE NUMBER** OF EACH ATTEMPTED QUESTION
- **START** EACH QUESTION ON A **NEW PAGE**
- ALL QUESTIONS CARRY EQUAL MARKS (20 MARKS).

SECTION A - ANIMAL ANATOMY AND PHYSIOLOGY

QUESTION ONE

Write short notes on the following terms as they are used in animal production;

(a) Seminiferous tubules **(4 Marks)**
(b) Broad ligament **(4 Marks)**
(c) Respiration **(4 Marks)**
(d) Formed elements of blood **(4 Marks)**
(e) Proventriculus **(4 Marks)**

QUESTION TWO

(a) State the compartments and functions of a ruminant stomach. **(8 Marks)**
(b) With the aid of examples, discuss the types of muscles found in farm animals. **(6 Marks)**
(c) Based on shape, state the types of bones found in farm animals. **(6 Marks)**

QUESTION THREE

(a) Describe four (4) anatomical differences between poultry and other domestic animals. **(4 Marks)**
(b) Using a well-illustrated diagram show the main features of a female reproductive system in farm animals. **(10 Marks)**
(c) Discuss four (4) modifications found in the respiratory system of farm animals. For each modification, state the purpose of that modification. **(4 Marks)**
(d) With regard to lung volumes, state any two volumes associated with the lung and indicate the significance of each chosen volume. **(2 Marks)**

SECTION B - ANIMAL HUSBANDRY

QUESTION FOUR

A farmer intends to rear 1, 500 'COBB 500' broilers next October. The birds are expected to reach an averag body weight of 2740g from an initial weight of 40g. Provided to you is a copy of the management guide f Cobb 500 broilers that the farmer intends to rear. Starter, grower and finisher feeds are to be fed from 0-2 22-35 and 36-42 days of age, respectively. Based on the guide provided, determine the following:

(i) Number of 50 kg bags of Starter feed to buy **(2 Marks)**

(ii) Number of 50 kg bags grower feed to buy **(2 Marks)**

(iii) Number of 50 kg bags of Finisher feed to buy **(2 Marks)**

(iv) How much area will be required to rear these birds? **(2Marks)**

(v) If starter, grower and finisher feeds cost K3.20, K3.00 and K2.90 per Kg of feed, respectively, ho much should the farmer budget for each type of feed for this batch of broilers? **(6 Marks)**

(vi) Why, how and when are the following operations carried out in layers?

- **(a)** Culling **(3 Marks)**
- **(b)** Debeaking **(3 Marks)**

QUESTION FIVE

(a) Differentiate the following terms used in animal production;

- **(i)** Calving interval and Gestation period **(2 Marks)**
- **(ii)** Selection and Culling **(2 Marks)**
- **(iii)** Steaming up and flushing **(2 Marks)**
- **(iv)** Hand mating and Pasture mating **(2 Marks)**

(b) Define the following terms used in dairy production;

- **(i)** Milk persistency **(1 Mark)**
- **(ii)** Herd **(1 Mark)**
- **(iii)** Cryptorchid **(1 Mark)**
- **(iv)** Bullying season **(1 Mark)**

(c) Mention any two physical features that generally differentiate dairy from beef cattle. **(4 Marks)**

(d) Explain why a dip tank is more effective and economical than a spray race for tick control. **(4 Marks)**

QUESTION SIX

(a) An orphaned beef calf to be artificially reared should have access to colostrum milk within the first 1
36 hrs of its life. State **three** (3) reasons, why this milk is important to calves **(6 Marks)**

(b) With Four (4) reasons, explain how you would tell that a heifer or cow is ready for mating. **(4 Marks**

(c) List down at least two reasons why each of the following routine management tasks are carried o
when managing beef cattle on the farm:

(i) Dehorning **(2 Marks)**

(ii) Castration **(2 Marks)**

(iii) Flushing **(2 Marks)**

(iv) Record keeping **(2 Marks)**

(v) Adhering to restricted breeding system **(2 Marks)**

Cobb500 Broiler Performance & Nutrition Supplement

Performance objectives - metric

AS HATCHED

Age days	Weight for Age (g)	Daily Gain (g)	Average Daily Gain (g)	Cumulative Feed Conversion	Daily Feed Consumption (g)	Cumulative Feed Consumption (g)
0	42	0				
1	56	14		0.232	13	13
2	72	16		0.417	17	30
3	89	17		0.573	21	51
4	109	20		0.679	23	74
5	131	22		0.773	27	101
6	157	26		0.841	31	132
7	**185**	**28**	**26.4**	**0.902**	**35**	**167**
8	215	30	26.9	0.958	39	206
9	247	32	27.4	1.012	44	250
10	283	36	28.3	1.053	48	298
11	321	38	29.2	1.097	54	352
12	364	43	30.3	1.126	58	410
13	412	48	31.7	1.150	64	474
14	**465**	**53**	**33.2**	**1.165**	**68**	**542**
15	524	59	34.9	1.177	75	617
16	586	62	36.6	1.191	81	698
17	651	65	38.3	1.206	87	785
18	719	68	39.9	1.221	93	878
19	790	71	41.6	1.235	98	976
20	865	75	43.3	1.250	105	1081
21	**943**	**78**	**44.9**	**1.264**	**111**	**1192**
22	1023	80	46.4	1.284	117	1309
23	1104	81	47.8	1.303	123	1432
24	1186	82	49.3	1.321	130	1562
25	1269	83	50.8	1.337	134	1696
26	1353	84	52.1	1.356	141	1837
27	1438	85	53.6	1.373	148	1985
28	**1524**	**86**	**54.4**	**1.402**	**152**	**2137**
29	1613	89	55.6	1.423	158	2295
30	1705	92	56.8	1.442	163	2458
31	1799	94	58.0	1.460	169	2627
32	1895	96	59.2	1.478	174	2801
33	1993	98	60.4	1.496	180	2981
34	2092	99	61.5	1.512	182	3163
35	**2191**	**99**	**62.6**	**1.530**	**189**	**3352**
36	2289	98	63.6	1.549	193	3545
37	2386	97	64.5	1.568	197	3742
38	2482	96	65.3	1.589	201	3943
39	2577	95	66.1	1.610	205	4148
40	2671	94	66.8	1.631	209	4357
41	2764	93	67.4	1.653	213	4570
42	**2857**	**93**	**68.0**	**1.675**	**216**	**4786**
43	2950	93	68.6	1.697	220	5006
44	3043	93	69.2	1.718	222	5228
45	3136	93	69.7	1.739	225	5453
46	3229	93	70.2	1.759	227	5680
47	3322	93	70.7	1.779	231	5911
48	3414	92	71.1	1.800	233	6144
49	**3506**	**92**	**71.6**	**1.819**	**235**	**6379**
50	3596	90	71.9	1.840	237	6616
51	3685	89	72.3	1.860	239	6855
52	3773	88	72.6	1.880	240	7095
53	3859	86	72.8	1.901	242	7337
54	3944	85	73.0	1.922	243	7580
55	4028	84	73.2	1.943	245	7825
56	**4111**	**83**	**73.4**	**1.963**	**245**	**8070**
57	4192	81	73.5	1.984	245	8315
58	4272	80	73.7	2.004	245	8560
59	4350	78	73.7	2.024	245	8805
60	4427	77	73.8	2.044	245	9050
61	4502	75	73.8	2.065	245	9295
62	4576	74	73.8	2.085	245	9540
63	**4649**	**73**	**73.8**	**2.105**	**245**	**9785**

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2018 ACADEMIC YEAR – END OF YEAR DEFERRED EXAMINATIONS

COURSE AGA 4311 – PRINCIPLES OF GENETICS

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

a. Answer any five (5) questions.
b. All Questions carry equal marks (20).
c. Clearly show all the calculations.

SECTION A

Q.1 a. In ***Drosophila melanogaster***, a gene that causes vestigial wings is 12.5 map units from the gene that causes purple eyes. A third gene that causes black body colour is 18.5 map units from the gene that causes vestigial wings and 6 map units from the gene that causes purple eyes. The alleles that cause vestigial wings, purple eyes and black body colour are all recessive. The dominant or wild type traits are long wings, red eyes and gray body colour. A researcher crossed the wild type flies to flies with vestigial wings, purple eyes and black body colour. All the F_1 flies were wild type. The researcher then crossed the F_1 female flies to male flies with vestigial wings, purple eyes and black body colour. If a total of 1, 000 progeny were observed, what are the expected numbers with the following types of flies?

Long wings, red eyes, gray body;
Long wings, purple eyes, gray body;
Long wings, red eyes, black body;
Long wings, purple eyes, black body;
Vestigial wings, red eyes, gray body;
Vestigial wings, purple eyes, gray body;
Vestigial wings, red eyes, black body; and
Vestigial wings, purple eyes, black body.

b. In humans, the gene for haemophilia (h) is sex-linked and recessive to the gene for normal blood clotting (h^+). Indicate/show the genotypes of the parents and the phenotypes of the progeny from the following crosses?

i. Haemophiliac woman **x** normal man;
ii. Normal (heterozygous) woman **x** haemophiliac man; and
iii. Normal (homozygous) woman **x** haemophiliac man.

Q. 2 Outline the structure of Deoxyribonucleic Acid (DNA) in relation to its function as a carrier of genetic information. How is this information translated to the sequence of amino acids in proteins?

Q. 3 With the aid of clear examples, write notes on the following:

a. Chromosomal mutations;
b. A test cross and its use;
c. Sex determination and linkage; and
d. Complementary as opposed to duplicate gene action.

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

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

SECTION B

Q. 5 Answer the following:

a. Define a population and explain why it is important to study the genetic constitution of a population;
b. State the law of Hardy-Weinberg equilibrium and briefly explain the five (5) factors that cause changes to the Hardy-Weinberg equilibrium;
c. Explain what is meant by the Mutation-Selection balance; and
d. Define inbreeding. Illustrate how to compute it and briefly explain how inbreeding increases the frequency of homozygotes in a population.

Q. 6 A new breed of cattle has coat colours: white (A_1A_1), brown, or black (A_2A_2). A large randomly-mating population was moved to Lusaka to mitigate low levels of beef production. The brown cattle are heterozygous and because producers in Lusaka prefer the brown cattle, 80% of these reproduce. The white cattle are less fortunate and only 40% reproduce while 60% of the black cattle reproduce. 50 out of 100 of the cattle in the initial population are white.

a. Calculate the relative fitness of each genotype;
b. Calculate the average fitness in the population;
c. Using the average fitness, calculate the new gene frequencies after a generation of selection; and
d. From the above, what is the frequency of the heterozygotes (brown cattle) after a generation of selection.

End of Examination

THE UNIVERSITY OF ZAMBIA

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2018 ACADEMIC YEAR – FIRST HALF EXAMINATIONS

COURSE AGA 4511 – Beef, Sheep and Goat Production
TIME ALLOWED: Three (3) hours only **Date: Monday 2nd July 2018**
INSTRUCTIONS TO CANDIDATES:

a. Answer any **five (5)** questions, **at least two (2) from each section.**
b. All Questions carry equal marks (20).
c. Use different answer books for each Section.

SECTION A – BEEF PRODUCTION

Q. 1 With the aid of clear examples, explain the meaning of the following terms:

a. Breeding Ratio
b. Breeding system
c. Calving percentage
d. Breeding season
e. Weaning percentage

Q. 2 Zambia's ability to capture the potential economic benefits of expanded beef industry is constrained by gaps in productivity and price competitiveness. The beef industry in Zambia has great potential to becoming a major foreign exchange contributor to the national treasury.

a. Give reasons as to why the beef industry has great potential for growth in Zambia.

b. What would it take for the industry to achieve its potential?

c. Zambia is endowed with a several indigenous cattle species that provide a wide range of social and economic importance in the lives of the local people. In recent years, survival threats for the indigenous cattle breeds have been on the increase:

i. Outline the importance of the local cattle breeds in the beef industry in Zambia.

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

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

Q. 3. a. It is very important to have the correct type of animal species to be used for draft power on the farm. Outline the factors that should be taken into consideration when selecting cattle as sources of animal draft power.

b. Outline the advantages and disadvantages of using donkeys as sources of animal draft power.

SECTION B – SHEEP AND GOAT PRODUCTION

Q. 4 The breeding management of sheep and goats determines the profitability of the enterprise. A farmer group in Katete District of the Eastern Province that comprises of traditional, extensive and intensive producers has been convinced to start sheep and goat enterprises in order to meet the high demand for mutton and chevon in the District. As a sheep and goat expert, prepare detailed notes for your presentation to on the breeding seasons of sheep and goats that are used in Zambia.

Q. 5 Selection is the process of choosing certain individuals as future parents of the next generation in preference to others. Selection is carried out in order to improve the average performance of sheep and goats.

a. Discuss with the same farmer group from Katete District of the Eastern Province the factors are the factors that should be taken into consideration in the process of selecting of ewes and nannies 50 does from a flock of 85 as breeding stock?

b. The same farmer group from Katete District of the Eastern Province intends to use artificial insemination on their flock of does. Discuss with them any ten (10) signs of oestrus (heat) in does that that they should expect look out for. he should out for in the 87 flock of sheep and goats.

Q. 6 a. Discuss with the same farmer group from Katete District of the Eastern Province would like to know why sheep and goats are more compatible to rear together than either of them with any other type of livestock.

b. Discuss with the same farmer groups the characteristics of any two breeds of sheep and goats that are ideal to rear for both mutton and chevon production under the traditional, extensive and intensive systems of management.

End of Examination

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2017 ACADEMIC YEAR:
FINAL EXAMINATIONS

AGA 4531: INTRODUCTION TO AQUACULTURE
THEORY PAPER

TIME: THREE HOURS

INSTRUCTIONS: **ANSWER FIVE** QUESTIONS. ANSWER QUESTIONS 1 **AND 5** AND ANY **THREE** OTHER QUESTIONS. ILLUSTRATE YOUR ANSWERS WHERE NECESSARY.

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1. Summarise each the following as commonly applied in fish biology:
   (a) Dorsal formula.
   (b) Growth coefficient (k).
   (c) Catadromous.
   (d) Holotype.
   (e) Gnathostomata.

2. Explain how each of the following affect fish growth rate.
   (a) Fish stocking density.
   (b) Age of the fish.
   (c) Temperature.
   (d) Food availability.
   (e) Spawning.

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 give reasons for the choice.

4. (a) Describe the main characteristics of the family Cyprinidae.
   (b) State any two Cyprinid species and their significance in aquaculture.
   (c) Assess the potential for farming Cyprinids in Zambian aquaculture.

5. Describe the structure, and functions of the flowing organs.
   (a) Tail.
   (b) Ventricle.
   (c) Swim blader
   (d) Pharynx
   (e) Yolk sac.

TURN OVER

6. (a) Summarise variations in feeding habits among fishes.
   (b) Indicate feeding habits of species commonly used in aquaculture.

7. Using appropriate examples, describe variations in fish gut structure in relation to feeding habits or trophic levels.

8. Discuss the design and structure of the circulatory system in fishes.

END OF THE EXAMINATION

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

DEFERRED EXAMINATIONS 2019/2020

COURSE : **AGA 4542 GAME RANCHING**
DATE : **MONDAY, 11 JANUARY 2021**
DURATION : **1 HOUR 30 MINUTES**
INSTRUCTIONS : **ANSWER ANY THREE QUESTIONS.**

Question 1

Mention and describe the four main Wildlife production systems in the world. Indicate the advantages and disadvantages of each system. **[20 marks]**

Question 2

The continued existence of wildlife and wilderness is important to the quality of human life

a. What is wildlife management? [5 marks]
b. List five (5) consumptive uses of wildlife. [5 marks]
c. It is a very important to understand the basic components of a habitat. Write, briefly on three (3) of these components. **[10 marks]**

Question 3

The Zambian game ranching industry is under-performing and compares extremely poorly with most other southern African countries in terms of: 1) the number of game ranches and area under game ranching; 2) the economic value of the industry; 3) the number of jobs created; the size of wildlife populations on game ranches; and 4) the quantities of meat produced.

Outline the key constraints limiting the Zambian game ranching industry and suggest interventions needed to improve industry performance. **[20 marks]**

Question 4

Aerial sample counting is the most frequently used method to assess the abundance of large ungulate species on the African continent. Since its first use in the 1950s, the technique has changed in many aspects. The accuracy has improved beyond recognition, mainly as a result of the introduction of the GPS as an aid in navigation, and a better understanding of the potential sources of bias.

a) Outline the advantages and the disadvantages of this method. **[12 marks]**

b) What are the four common mistakes made by observers on transect counts in aerial counts. **[8 marks]**

THE END

END OF EXAMINATION

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

DEFERRED EXAMINATIONS 2019/2020

COURSE : **AGA 4552 ANIMAL PRODUCTS AND BY-PRODUCTS**
DATE : **WEDNESDAY, 13TH JANUARY 2021**
DURATION : **I HOUR 30 MINUTES**
INSTRUCTIONS : **ANSWER THREE QUESTIONS. EACH SECTION SHOULD BE WRITTEN IN A SEPARATE ANSWER BOOKLETS**

SECTION A

ANSWER AT LEAST ONE QUESTION FROM THIS SECTION

1. Meat structure, Firmness and Texture are meat properties usually evaluated by consumers with visual (sight) or tactile (touch) senses. Explain briefly all the factors that influence meat structure, firmness and texture (20 Marks).

2. In the production of hides/skins, it easier to control the sources of defects and faults if one is knowledgeable on the causes. Defects and faults are caused at different stages of the animal's life, and these degrade the quality of hides/skins.
   a) What is the difference between a skin and a hide?
   b) Explain how defects and faults may occur in hides/skins and how one can minimise their occurrence;
      i) During the animal's life
      ii) During slaughtering and flaying (20 Marks)

3. People eat meat for various reasons which include tradition, nutritive value, availability, wholesomeness, variety, satiety value, and social or religions customs. Meat is also a highly pleasing food for many people, and the consumption of it is a measure of societal status world over but the ultimate eating quality of meat is dependent on the palatability and nutritive value. Write short notes on;
   a) Stunning
   b) Colour of meat
   c) Water Holding Capacity of Meat
   d) Rigor mortis (20Marks)

SECTION B

Q4. Raw milk can be processed into many different products that can be consumed by human beings.

i. Give an overview of the general processing options of raw milk into marketable products.
ii. Name five processed milk products that are available on the Zambian Market.

Q5. Size, shape, and colour are physical characteristics that are among the standards usedwhen grading eggs according to quality. These characteristics also affect consumer acceptance of the eggs. Write briefly on the following:

i. Any six (6) factors that affect the size of eggs produced by a hen.
ii. Any three (3) factors associated with egg shape variation.
iii. One factor that affects the colour of eggs produced.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2018 Academic Year – First Half Examinations

Course AGA 5121 – Advances in Animal Nutrition

Date: Monday 2nd July 2018 **Time Allowed: Three (3) Hours Only**

Instructions to Candidates:

a. Answer any five (5) questions.
b. Each question carries equal marks (20 Marks).
c. Use separate answer books for each section.

SECTION A (RUMINANT NUTRITION):

Q. 1 Soon after being employed as a Farm Manager at Chisamba Feedlot, you have requested to compound a complete feedlot ration for beef steers by making use of on-farm readily available feed ingredients in order to reduce the cost of production. The results of the analyses of the available feedstuffs are as indicated in Tables 1 and 2 below.

Table 1: Analysis of some of the available feed ingredients:

FEED	DM%	DCP%	TDN%	Ca	P
Rhodes/Silver Leaf Hay	92	22.5	58	1.90	0.20
Maize Bran	90	12.5	70	0.07	1.62
Molasses	75	4.0	85	1.19	0.11
Soyabean Straw	88	25.0	65	0.69	0.06
Dicalcium Phosphate	-	-	-	26.0	18.00
Limestone Flour	-	-	-	38.0	0.04
Mineral Premix	-	-	-	-	-
Salt	-	-	-	-	-

Table 2: Analysis of other available feed ingredients:

FEED	DM%	DCP%	TDN%	Ca	P
Maize Meal	89	10.0	88	0.03	0.31
Groundnut Meal	95	43.0	90	0.18	3.62
Groundnut Haulms	87	12.0	62	0.07	0.17
Lucerne Hay	90	15.0	60	0.27	0.03

Formulate a dry season complete feedlot ration containing 14.0% DCP and 75% TDN for the beef steers by using the Double Pearson Square method. The feedlot ration must include 15% Rhodes Grass/Silver Leaf Hay mixture, 10% Soyabean

Straw, 5% Maize Bran, 2% Sugarcane Molasses, 1% Di-calcium Phosphate, 1% Mineral Premix and 1% Salt, on dry matter basis.

Q. 2 a. Calculate the concentrate mixture consisting of 30% Maize Meal, 30% Cottonseed Cake, 30% Cassava Meal and 10% Cane Molasses that should be fed to provide sufficient energy to maintain a 620 kg empty Friesian cow that is losing 0.5 kg body weight per day two weeks post-partum that is consuming 30 kg/day Maize Silage and produces 25 kg/day milk containing 3.8% butterfat (BF) and 8.8% solids-not-fat (SNF) per kg?

The following may be used to answer the question:

	DM (g/kg)	**ME (MJ/kg DM)**
Maize Silage	300	9.0
Maize Meal	870	12.5
Cane Molasses	770	14.0
Cottonseed cake	920	12.5
Cassava meal	870	11.0

b. Calculate the anticipated milk yield of the Friesian cow in Q. 1 a. above at peak milk production.

c. If the Friesian cow in Q. 1 a. above was actually in mid-lactation and there was no live-weight change in her body weight, calculate the concentrate mixture that should be fed her.

d. If the Friesian cow in Q. 1 a. above was actually in late lactation and was gaining 0.25 kg per day, calculate the concentrate mixture that should be fed to her?

e. How much is an Angoni steer weighing 345 kg expected to grow that is fed on a daily ration consisting of the following feed-stuffs:

10.0 kg Maize Silage (300 g/kg DM, 8.6 MJ ME/kg DM)
7.0 kg Feedlot Meal (850 g/kg DM, 12.5 MJ ME/kg DM)
3.0 kg Cane Molasses (270 g/kg DM, 13.0 MJ ME/kg DM)

f. Using the Rapid Formulation Method, calculate the forage (Maize Silage) and concentrate (Feedlot Meal) dry matter intake for the Angoni steer in Q. 1 e. above that should be fed to the steer so that it does not weight?

Q. 3 a. Ruminant animals, unlike monogastric animals, are able to subsist entirely on vegetative materials. Discuss this statement by highlighting the functions of micro-organisms in the ruminant stomach and the symbiotic relationships that exists between the ruminant animal and microbes.

b. Discuss the causes, methods of prevention and treatment of acidosis.

SECTION B (NON-RUMINANT NUTRITION):

Q. 4 a. Using a Pearson square, formulate a broiler starter diet to have 21% crude protein (CP) using maize meal, soybean meal, di-calcium phosphate (DCP) and a mineral vitamin premix. The DCP and the premix are fixed at 4.5 and 0.5% of the diet, respectively. What are the energy, calcium and phosphorus contents of this diet? The nutrient composition of the required ingredients is as given in Table 1.

Table 1: Nutrient composition of feed ingredients needed for the formulation of the ration.

Ingredient	Protein (%)	Energy (Kcal/kg)	Calcium (%)	Phosphorus (%)
Maize	9.0	3300	0.03	0.3
Soy bean meal	44.0	2900	0.5	0.65
DCP	0.0	0.0	24.0	18.0
Premix	0.0	0.0	0.0	0.0

b. Using algebraic expressions formulate a pig grower diet to have 17% crude protein (CP) using maize meal, barley, soy bean meal, DCP and a premix. The inclusion level for barley is fixed at 17%, while that of DCP and premix are at 1.5 and 0.3%, respectively. What are the energy, calcium and phosphorus contents of the diet? The nutrient composition of the required ingredients is as tabulated in Table 2.

Table 2: Nutrient composition of feed ingredients needed for the formulation of the ration.

Ingredient	Protein (%)	Digestible Energy (kcal/kg)	Calcium (%)	Phosphorus (%)
Maize	9.0	3300	0.03	0.4
Barley	12.0	3000	0.05	0.53
Full fat soya	38.0	3200	0.60	0.75
DCP	0.0	0.0	24.0	18.0
Premix	0.0	0.0	0.0	0.0

Q. 5 a. Explain the advantages and disadvantages of using true metabolizable energy (TME) rather than apparent metabolizable energy (AME) when estimating energy requirements in poultry species and why is it important to correct the generated figures for nitrogen balance in the chickens?

b. Explain in detail the steps you may have to undertake to determine the true metabolizable energy value of poultry feeds using layer breed cockerels and why are cockerels preferred for this estimation?

Q. 6 a. "The processing of grain cereals and legumes into bio-fuels has resulted in increased completion for the use of such grains as human or animal feed products". Explain the merits and demerits of such a statement?

b. Current consumer preferences in the developing world is bent towards increased demand for foods of animal origin that are produced under organic farming methods with minimum use of veterinary drugs or anti-microbials. What are some of the challenges among small scale farmers in satisfying the demands of a modern consumer especially those in the western world?

End of Examination

The following may be used to answer the questions:

i. $Ml = \frac{EVl \times 1.05}{0.62}$

ii. $Kg = 0.0435\ M/D$

iii. $MEP = MER - Mm$

iv. $Mm = 8.3 + 0.091\ W$

v. $FD = \frac{DMI\ (MC - M/D)}{(MC - MF)}$

vi. $DMI = 0.025\ W + 0.1\ Y$

vii. $Eg = \frac{MEP \times 0.0435\ M/D}{1.05}$

viii. $Eg = MEP \times 0.0414\ M/D$

ix. $DMI = 0.025\ W + 0.1\ Y - 2.5$

x. $LWG = \frac{Eg}{6.28 + 0.3\ Eg + 0.0188\ W}$.

xi. $Kl = \frac{0.0435\ M/D}{1.05}$ or $0.0414\ M/D$

xii. $EVl = 0.0386\ BF + 0.0205\ SNF - 0.236$

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – NOVEMBER 2020

AGA 5121 – Advances in Animal Nutrition

Time allowed: Three (3) Hours Marks: 60

INSTRUCTIONS TO CANDIDATES:

a. Answer any **three (3)** questions.
b. All Questions carry equal marks (20).
c. Use different answer books for each Section.

SECTION A (RUMINANT NUTRITION):

Q. 1 a. How much concentrate mixture consisting of 40% Maize Meal, 40% Cottonseed Cake, 10% Cassava Meal and 10% Cane Molasses should be fed to provide sufficient energy to maintain a 500 kg empty Friesian cow that is losing 0.5 kg body weight per day two weeks post-partum yet the cow consumes 20 kg/day maize silage and produces 25 kg/day milk containing 3.6% butterfat (BF) and 8.8% solids-not-fat (SNF) per kg?

(10 marks)

The following may be used to answer the question:

	DM (g/kg)	ME (MJ/kg DM)
Maize silages	300	9.0
Maize Meal	870	12.5
Cane Molasses	770	14.0
Cottonseed cake	920	12.5
Cassava meal	870	11.0

b. Calculate the expected peak milk yield of the cow in Q. 1 a.

(1 mark)

c. If the Friesian cow in Q. 1 a. above was actually in mid-lactation with no live-weight change in her body weight, how much concentrate mixture should she be fed?

(3 marks)

d. If the Friesian cow in Q. 1 a. above was actually in late lactation and was gaining 0.5 kg per day, how much concentrate mixture should she be fed?

(3 marks)

e. Using the Rapid Formulation Method, calculate the forage and concentrate dry matter intake of the Friesian cow in Q. 1 a. above?

(3 marks)

Q. 2 Ruminants, unlike monogastrics, are able to subsist entirely on vegetative or cellulosic feed materials. Micro-organisms, mainly bacteria and to some extent protozoa and fungi, ferment/breakdown ingested cellulosic feed materials to soluble products that ruminants consume.

a. Discuss the functions of the micro-organisms that are found in the ruminant digestive system and the benefits that are enjoyed by the ruminant animal; and

(10 marks)

b. Urea, just like other NPN compounds, is a very useful compound that is incorporated in dry season ruminant rations. However, urea can be deadly poisonous. Write notes on the causes of poisoning, prevention and treatment of urea poisoning in beef cattle.

(10 marks)

SECTION B (NON-RUMINANT NUTRITION):

Q. 3 a) Explain the steps you should follow when selecting feed ingredients for use in formulating rations for non-ruminants under your care?

(10 Marks)

b) Using Pearson square formulate a ration for growing pigs to have 1.6% Methionine using Maize Meal and Soya bean meal? The ration is also expected to have 1.5% Di-calcium Phosphate, 0.3% salt and 0.7% vitamin and mineral premix (10 Marks)?What is the protein, energy, calcium and phosphorus content in the ration? You are advised that the nutrient composition of required ingredients is as given in Table 1.

(10 Marks)

Table 1: Nutrient composition of ingredients needed for formulating the quail grower ration.

Ingredient	Methionine (%)	Protein (%)	Energy (kcal/kg)	Calcium (%)	Phosphorus (%)
Maize	0.96	9	3400	0.03	0.40
Soy bean meal	2.78	44.5	2800	0.45	0.65
DCP	0.0	0.0	0.0	24	18
Salt	0.0	0.0	0.0	0.0	0.0
Vit/mineral Premix	0.0	0.0	0.0	0.0	0.0

Q. 4 a) Using algebraic expressions; formulate a pig grower ration to have 16% crude protein using Maize, Barley and Soya bean meal. You are advised that the Diet is also supposed to have Limestone, Di-calcium Phosphate and a vitamin/mineral pre-mix that are fixed at 3.0, 2.5 and 0.5% of the diet, respectively. Barley is also fixed at 18.0% of the diet. What is the energy, calcium and Phosphorus contents of the diet assuming the nutrient composition of the ingredients required for the formulation are as tabulated in Table 2?

(10 Marks)

Table 2: Nutrient composition of feed ingredients used in the formulation of pig grower ration.

Ingredient	Crude Protein	Energy	Calcium	Phosphorus
Maize	9.0	3300	0.04	0.30
Barley	11.0	3400	0.03	0.25
Soy bean meal	44.0	2900	0.45	0.65
Limestone	0.0	0.0	38.0	0.0
DCP	0.0	0.0	24.0	16
Vit/mineral Premix	0.0	0.0	0.0	0.0

b) The utilization of cereals and legumes for the production of bio-fuels as created shortage of these grains for stock feed production thereby causing an increase in animal feeds. Discuss the merits and de-merits of the above statement?

(10 Marks)

End of Examination

The following may be used to answer the questions:

i. $MI = \frac{EVI \times 1.05}{0.62}$

ii. $Kg = 0.0435\ M/D$

iii. $MEP = MER - Mm$

iv. $Mm = 8.3 + 0.091\ W$

v. $FD = \frac{DMI\ (MC - M/D)}{(MC - MF)}$

vi. $DMI = 0.025\ W + 0.1\ Y$

vii. $Eg = \frac{MEP \times 0.0435\ M/D}{1.05}$

viii. $Eg = MEP \times 0.0414\ M/D$

ix. $DMI = 0.025\ W + 0.1\ Y - 2.5$

x. $$LWG = \frac{Eg}{6.28 + 0.3\ Eg + 0.0188\ W}.$$

xi. $$Kl = \frac{0.0435\ M/D}{1.05} \text{ or } 0.0414\ M/D$$

xii. $EVl = 0.0386\ BF + 0.0205\ SNF - 0.236$

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

FINAL EXAMINATIONS: FIRST HALF- 2017/18 ACADEMIC YEAR
COURSE: AGA 5321 APPLIED ANIMAL REPRODUCTION
DURATION: THREE (3) HOURS

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

SECTION A

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

QUESTION ONE

A) What Write short notes on the following terms as used in animal reproduction. [20]

i. Puberty
ii. Placentome
iii. Broad ligament
iv. Estrumate®
v. CIDR®

B) Profitable animal production enterprises rely on successful reproduction.
   i. State the puerperium changes that an animal needs to undergo? [5]
   ii. How might the changes named in B] i. impact reproduction? [5]

QUESTION TWO

A) With the aid of a diagram describe the segments and role of the segments of a spermatozoon. [9]
B) Briefly explain what factors predispose parturition in animals. [6]
C) Explain the nature of follicular dynamics as they occur in cattle. [3]
D) Discuss three factors that contribute towards lowering reproductive efficiency of farm animals. What assisted reproductive technique would you use to resolve each of these? [12]

QUESTION THREE

A) With regard to Animal biotechnology;

i. What factors influence the attainment of puberty in animals? [4]
ii. Describe the deficiencies in nature that MOET seek to resolve. [5]
iii. What is meant by and what is the benefit of semen and embryo sexing? [4]
iv. What is the basis of a laboratory test for pregnancy? [2]

B) A farmer calls you requesting assistance to resolve the following cases;

i. A cow constantly exhibiting oestrus every 10 days. [3]
ii. A mature female animal that does not exhibit oestrus? [3]
iii. Pregnant animals consistently giving rise to male calves? [3]
iv. Semen analysis shows cytoplasmic droplets on some spermatozoa. [3]
v. Early embryo evaluation show several male pronuclei. [3]

SECTION B

INSTRUCTIONS: ANSWER BOTH QUESTIONS IN THIS SECTION

QUESTION ONE **(20)**

a). For a dairy enterprise to be successful, it is essential that oestrus detection is efficiently conducted. In the event that inefficiencies are observed, discuss five aids that you would recommend in order to improve oestrus detection [5]
b). Discuss the factors that predispose reproductive failure in a dairy herd. [5]
c). How would you resolve the causes of reproductive failure discussed above? [5]
d) Describe the types of uteri found in animals. [5]

QUESTION TWO

a) You have been requested to establish an artificial insemination programme for your centre or farm. Describe five key requirements that you will order. Explain the purpose of each of the requirements you intend to order. (10)

b) An assessment conducted at a farm indicated very low reproductive efficiency. Choose five (5) assisted reproductive technologies you would recommend and state the rationale for each choice made. [10]

END OF EXAMINATION – GOOD LUCK – BOONE CHANCE

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF PLANT SCIENCE
Third Year Examinations for Bachelor of Agricultural Sciences
AGC 3121: CROP PRODUCTION
Final Examination 2018 Academic Year

Date: 5th July 2018 **Time: 9:00 – 12:00 hrs** **Venue: OMNIA 1&2**

Instructions: There are two Sections, A and B.
Use a separate answer booklet for each Section.
Instructions are as given per Section.

Section A

Question 1

a. Discuss the economic importance of Sorghum (*Sorghum bicolor*). **(16 marks)**

b. Briefly explain why Millets are important foods when there is a famine. **(4 marks)**

Question 2

a. Describe the process of harvesting Cotton (*Gossypium spp*). **(13 marks)**

b. In Wheat (*Triticum spp.*) production, bird damage is a serious problem when the crop has come to maturity especially where the crop is grown in small areas. Discuss this statement in detail including measures to be undertaken to reduce on bird damage. **(7 marks)**

Question 3

a. As an Organic Extension worker, you have been requested to give a presentation on Green Manures to a group of farmers in Chongwe District who intend to grow organic crops. What would you include in your presentation? **(10 marks)**

b. List four (4) principles that govern Organic Agriculture. **(4 marks)**

c. List 2 crops which are sensitive to boron deficiency. For each crop, what is the effect of this deficiency? Your answer should include remedial measures to be undertaken.

(6 marks)

SECTION B

Question 4

a. The Government of the Republic of Zambia is moving from Conservation to Smart Agriculture. Explain how this practice is different from Conservation Agriculture.

(6 marks)

b. As the Manager of a crop production project, you are informed that the hand-hoe has been banned. In fact it has been banned in the whole of the SADC Region. The hand-hoe should be banished to the museums. What alternative technologies will you offer your farmers for crop production? **(9 marks)**

Question 5

i) Describe the production practices which you carried out until your last measurements of Maize *(Zea mays)* crop performance. **(5 marks)**

ii) Describe the effective rooting depth of crops and how it can be determined from data of your Maize crop which you grew given in Table 1. **(10 marks)**

Table 1: Standard and neutron count rate in the given soil profile

Depth	Date 1	Date 2	Date 3
STD	2748	2755	2813
15cm	2646	2562	2540
30cm	2747	2666	2703
45cm	2852	2774	2876
60cm	2785	3050	3071

iii) Explain the performance of your Maize crop with respect to the soil moisture content given in Table 1. **(10 marks)**

Table 2: Parameters measured in selected maize plants

PLANT No	DATE	PLANT HEIGHT (cm)	PLANT DIAMETER (cm)	CHLORPHYLL
P1	1	67.0	3.0	29.4
	2	120.0	4.0	20.5
	3	122.0	4.5	12.0
P3	1	68.5	3,1	23.0
	2	125.0	4.3	17.5
	3	132.0	6.0	20.2
P7	1	69.0	2.6	34.3
	2	137.0	3.8	24.4
	3	156.0	4.0	38.9
P9	1	68.0	2.5	40.0
	2	107.0	3.9	14.3
	3	111.0	4.0	15.8

End of Exam

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF PLANT SCIENCE
Third Year Examinations for Bachelor of Agricultural Sciences
AGC 3121: CROP PRODUCTION
Final Examination 2019 Academic Year

Date: 11th July 2019 **Time: 9:00 – 12:00 hrs** **Venue: OMNIA 1, 2&3**

Instructions: There are two Sections, A and B.
Use a separate answer booklet for each Section.

Section A

Question 1

a. As an Agronomist for Kaputa District, you have been approached by a farmer who intends to grow Finger Millet (*Eleusine coracana*) for the first time. Give full details on the options he has regarding the method(s) of planting. Your answer should include information he needs to know **at** planting.

(12 marks)

b. Cotton and Wheat are sensitive to boron deficiency. Indicate the effect of boron deficiency on each crop. **(3 marks)**

Question 2

a. A farmer growing Rice (*Oryza sativa*) is about to harvest her crop. As an Agricultural Officer for Mambwe District, advise the farmer on how she should harvest her crop up to the time it is ready to be put in bags clearly describing the processes in chronological order. **(12 marks)**

Question 3a

(i) What is a pesticide? **(1 mark)**

(ii) Give two(2) examples of the insecticides used to effectively control *Spodoptera frugiperda* in a *Zea mays* crop. **(2 marks)**

(iii) Mention the mode of action for the two(2) insecticides mentioned in (ii). **(2 marks)**

(iv) List and explain four (4) modes of action for a fungicide like Benomyl. **(13 marks)**

Question 3b

Mr. Mugala has three (3) hectares of land for his small farm holding and he wants to venture into Maize (*Zea mays*) production for sale. He ploughed 0.25 ha in readiness for his Maize (variety ZM 528) cultivation. For (i), (ii) and (iii), clearly show each step of your calculation.

(i) Advise Mr. Mugala on the expected plant population on his farm holding using the recommended inter-row spacing of 75cm and intra-row spacing of 30cm. **(3 marks)**

(ii) Using the fertilizer application rate of 200kg/ha as basal fertilizer, calculate the quantity of fertilizer required for Mr. Mugala's farm. **(2 marks)**

(iii) Advise Mr. Mugala on the quantity of fertilizer required per plant. **(2 marks)**

(iv) List the elements found in Compound D and their importance to Maize production. **(8 marks)**

SECTION B

Question 4

You have successfully carried out a study on production of irrigated Maize (*Zea mays*) at the Field Station of the School of Agricultural Sciences of the University of Zambia.

i) Explain to your farmers the activities you carried out to produce such a high-yielding Maize crop. **(4 marks)**

ii) Refer to the measurements of the above ground biomass in Table 1 and how they relate to the soil water measurements in Table 2 which you carried out with the Neutron moisture probe. **(6 marks)**

iii) Also explain the difference in Maize performance in Field 1 compared to Field 2. **(5 marks)**

iv) At what depth are most of the roots located? **(5 marks)**

Table 1: Parameters measured in the irrigated Maize crop

TRAIT	DATE	FIELD 1	FIELD 2
Plant Height (cm)	Date 1	101.0	116.0
	Date 2	153.8	170.0
	Date 3	187.7	190.0
Stem diameter (cm)	Date 1	2.3	3.0
	Date 2	3.0	3.9
	Date 3	3.3	4.1
Leaf diameter (cm)	Date 1	6.9	9.1
	Date 2	8.2	10.6
	Date 3	11.1	13.8
Chlorophyll Content Index	Date 1	31.0	40.1
	Date 2	37.1	46.0
	Date 3	41.0	54.1

Table 2: Soil moisture measurements with the Neutron probe

Depth	Measurement	Date 1	Date 2	Date 3
	Standard count	2748	2755	2813
15cm		2646	2562	2540
30cm		2747	2666	2703
45cm		2852	2774	2876
60cm		2785	3050	3071

Question 5

In another study, you evaluated Cowpea (*Vigna unguiculata*) genotypes for tolerance to drought.

i) With soil moisture measurements you carried out with the Neutron moisture probe in Table 3, determine which genotype was more tolerant to drought. **(12 marks)**

ii) Support your decision with additional measurements of the above ground biomass of the cowpea genotypes in Table 4. **(8 marks)**

Table 3: Soil moisture content (%) with depth for selected Cowpea genotypes

DEPTH	BB8-1-5-2	LT11-3-3-13	BBPRT	LTPRT
15 cm	21.39	13.69	22.01	24.84
30 cm	23.78	19.36	24.93	25.49
45 cm	25.06	22.51	24.93	26.55

Table 4: Parameters of above ground biomass measured

GENOTYPE	CATEGORY	CCI	STEM LENGTH	FLOWERING
Bubebe (BB) PRT	Parental variety	30.875	Short	Fewer flowers
BB8-1-5-2	Mutant	32.25	Longer	More flowers
Lutembwe (LT)	Parental variety	15.05	Short	Fewer flowers
LT11-3-3-13	Mutant	66.2	Longer	More flowers

Key:

PRT - Parental variety

CCI - Chlorophyll Content Index

End of Exam

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – DECEMBER 2020

AGC 3135
FUNDAMENTALS OF PLANT SCIENCE

TIME: 1 Hour 30 Minutes Marks: 100

INSTRUCTIONS:

- **ANSWER IN THREE (3) QUESTIONS.**
- **MARKS ARE AS INDICATED**

Question 1 [30 Marks]

i) What is the importance of Photosynthesis to food production on planet Earth? **[10 Marks]**

ii) Describe the distinguishing features between C3 and C4 plants **[10 Marks]**

iii) Describe the three partial processes of Photosynthesis. **[10 Marks]**

Question 2 [35 Marks]

i) What are the aspects of light important for plant growth? **[10 Marks]**

ii) What is vernalization, and how is it used in crop production? **[10 Marks]**

iii) Given the minimum, optimum and maximum temperature for germination of the crops listed in Table 1, what is the appropriate time of the year to grow these crops? **[15 Marks]**

Table 1: Temperaturwe for crop germination

CROP	TEMPERATURE		
	Min T °C	Opt T °C	Max T °C
Wheat	4	29	42
Maize	10	34	46
Sunflower	5	35	47
Pumpkin	11	34	46
Sorghum	12	36	48

Question 3 [35 Marks]

A young ambitious farmer wants to establish ten (10) hectares of Banana plantation in the lower Zambezi Valley of Lusaka province. As an expert in Tissue Culture, explain to the young farmer the following:

i) What is Plant Tissue Culture? **[8 Marks]**
ii) Any four advantages of planting tissue cultured banana plantlets **[7 Marks]**
iii) Stages of micro propagation of banana plantlets. **[15 Marks]**
iv) How can plant tissue culture be used in genetic engineering? **[5 Marks]**

Question 4 [35 Marks]

You have carried out an experiment on Hydroponics on the effect of plant nutrients on plant growth. The parameters measured are shown in Table 1.

i. Determine the difference in the parameters measured in the treatments where all the 16 plant nutrients were applied and where one element was missed in the nutrient solution. **[20 Marks]**.
ii. Explain the difference of the functions of the plant nutrients in plant growth. **[15 Marks]**

Table 2: Parameters measured in sorghum seedlings

CROP	PARAMETER	ALL ELEMENTS (16)	- Zn	- Ca	-B
Wheat	Shoot length (cm)	18.6	19.0	6.5	7
	Root length (cm)	14.0	14	10.5	10.7
	Root numb1r	7	5	2	8

END OF EXAM

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF PLANT SCIENCE

PRINCIPLES OF WEED MANAGEMENT AGC5331

FINAL EXAMINATION FOR FIFTH YEAR PLANT SCIENCE STUDENTS

DATE: 6TH JULY 2018

VENUE: OMNIA LECTURE THEATRE 1

TIME ALLOWED: THREE (3) HOURS 09:00 – 12:00hours

INSTRUCTIONS

This paper is divided into two sections. Section I is compulsory and must be answered. In section II, answer only two of the three questions asked. Points for each question are indicated.

SECTION I

COMPULSORY

Q1 (30)

Discuss weed ecology and how this is the basis for most of the weed management techniques.

SECTION II

OPTIONAL QUESTIONS

Q2 (15 points)

a) List ten (10) weeds from ten different families found in the Field Station of the University of Zambia.
b) What are your proposals for effectively and practically managing the weeds in the Field Station?

Q3 (15 points)

Compare and contrast the important interactions found been crops and weeds.

Q4 (15 points)

a) What are the major differences among benzoics, bipyridiliums, phenoxys, triazines and uracils.
b) Give an example of a herbicide found in each of the groups above.

End of Final Examination!

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF PLANT SCIENCES, B. Agric. Sci. PROGRAMME
AGC 5421 ADVANCED HORTICULTURE
First Semester- 2016/2017 Academic Year, FINAL EXAMINATION
Date: 9th JULY 2018 Time: 09:00 to 12:00 hrs.

INSTRUCTIONS

i. **Answer any 5 (FIVE) questions.**
ii. **All questions carry equal marks.**
iii. **Duration 3 hours.**

---

1) Describe the different glazing and building components used in green house construction.

[20 marks]

2) As part of Horticultural extension activities you are asked to develop a pamphlet for small scale rural horticultural growers on profitable banana (*Musa* spp) production. The pamphlet should include but not restricted to the following headings;

i. Soils and climate,

ii. Planting and planting materials,

iii. Varieties,

iv. Fertiliser and other soils amendments,

v. Pests and diseases,

vi. Harvesting and yield. **[20 marks]**

3) As a researcher seeking to improve avocado (*Persea* spp) fruit production in Zambia what characteristics would you consider critical for the following;

i. Scion varieties,

ii. Rootstock varieties. **[20 marks]**

4) Describe the importance of holding consultations with clients, surveying, grid making and garden forms in landscaping. **[20 marks]**

5) Give a detailed description of the relationship between climate and fruitfulness (productivity) in mango (*Mangifera indica*). **[20 marks]**

6) Briefly describe any 2 of the following;

   i. Cuttings and budding.
   ii. Soils and climatic requirements for Cashewnut (*Anacardium occidentale*).
   iii. Three (3) types of financial records kept by plant nurseries. **[20 marks]**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
Department of Agricultural Economics and Extension

2018 Academic Mid-Year Examination

AGE 2111 Fundamentals of Microeconomics

Duration: Three (3) hours

INSTRUCTIONS: The marks for each question are as indicated. Answer **ALL** the questions.

1) A. Suppose a market consists of three consumers A,B and C whose inverse demand functions are given below:

(A): $P = 35 - 0.5Q_A$
(B): $P = 50 - 0.25Q_B$
(C) $P = 40 - 2.00Q_C$

i. Find out the market demand function for the commodity **(5 marks)**
ii. If the market supply function is given by $Q_S = 40 + 3.5P$, determine the equilibrium price and quantity **(5 marks)**

B. Distinguish between the movement along a demand curve and a shift in the demand curve. **(10 marks)**

2) You are given the following marginal utilities of goods X and Y obtained by a consumer. Given that price of X = K5, Price of Y =K2 and income = K22.

Number of units consumed of commodity	MU_X ***(utils)***	MU_Y ***(utils)***
1	30	20
2	25	18
3	20	16
4	15	14
5	10	12
6	5	10
7	1	8

i. Find out the optimal combinations of goods **[10 marks]**

B. (i) Explain consumers equilibrium condition with the help of indifference curve approach **[5 marks]**

(ii) What is a budget line? What does its intercept on X axis show? What does its intercept on Y axis show? What does the slope of the budget line measure? **(5 marks)**

3) Answer the following questions

a. What are the three stages of the short-run production function? Why does it not make any economic sense to produce in stage 1 or 3? (7 marks)

b. I) what is an isoquant? (1.5 marks)

ii) Why does an isoquant slope downward? (1.5 marks)

iii) Why can't isoquants cut each other? (1.5 marks)

iv) Why are they convex to the origin? (1.5 marks)

c. Suppose a firm faces a cost function of $C = 8 + 4q + q^2$

i) What is the firm's fixed cost? (3 marks)

ii) Derive an expression for the firm's variable cost and marginal cost. (3 marks)

d. The long run average cost curve is the locus of the minimum points of the short-run average cost curves. True or false? Explain. (6 marks)

4) A. A competitive firm has the following data

Output (Q)	TFC (K)	TVC (K)
0	100	0
1	100	50
2	100	90
3	100	140
4	100	200
5	100	280
6	100	380

i) If price is K60, how many units will the firm produce? (2 marks)

ii) What will be level of profits/losses at this level of production? (1 mark)

iii) Will the firm operate in the short-run? (1 mark)

iv) What happens in the long-run? (2 marks)

b) Does the monopolist always set price above marginal cost? Will he ever produce at the maximum point of the long-run average curve? (7 marks)

c) Explain and distinguish between first degree and second degree price discrimination. What additional profit will the firm get while practising perfect first degree price discrimination? (6 marks)

d) What is monopolistic competition? Explain the important features of monopolistic competition. (6 marks)

5) Briefly explain what you understand by the following concepts;

i. Floor price (2 marks)
ii. Complementary goods (2 marks)
iii. Law of diminishing marginal utility (2 marks)
iv. Income effect (2 marks)
v. Cartel (2 marks)

THE UNIVERSITY OF ZAMBIA
Department of Agricultural Economics and Extension

2019 Academic Mid-Year Examination

AGE 2111 Fundamentals of Microeconomics

Duration: Three (3) hours

INSTRUCTIONS: The marks for each question are as indicated. Answer **ALL** the questions.

1) Given the following market demand function for the commodity X:

$$Q = f(P_x, P_y, P_z, I.T.A)$$

Where: P_x = Price of commodity X, P_y = Price of substitute commodity Y, P_Z = Price of commodity Z which is complement of X, I = Level of per capita income of consumers, T= Tastes and Preferences, A= Advertising expenditure by firm producing X

How will the market demand for a commodity change?

a. If price of the commodity X rises **(4 marks)**
b. If price of the good Y rises **(4 marks)**
c. If price of good Z falls **(4 marks)**
d. Per capita income rises **(4 marks)**
e. Advertising expenditure increases **(4 marks)**

2) Consider a competitive market for which the quantities demanded and supplied at various prices are given as follows:

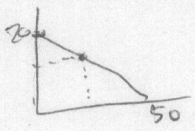
Price	Demand	Supply
60	22	14
80	20	16
100	18	18
120	16	20

a. Define price elasticity of demand **(2 marks)**
b. Calculate the price elasticity of demand when the price is 80 and when 100 **(6 marks)**
c. Calculate the price elasticity of supply when the price is 60 and when 120 **(6 marks)**

d. Suppose the government sets a price ceiling of 80, will there be a shortage or surplus and if so quantify it. **(6 marks)**

3) Answer the following questions

a. Explain why indifference curves



$\frac{X_2 - X_1}{20-0}$
$\frac{}{50-0}$

i) Have negative slopes **(3 marks)**

ii) Do not intersect each other **(3 marks)**

iii) Are convex to the origin? **((3 marks)**

b. Chanda's budget line relating good X and Y has intercepts of 50 units of good X and 20 units of good Y. If the price of good X is 12;

i) What is Chanda's income? **(3 marks)**

ii) What is the price of good Y. **(3 marks)**

iii) What is the slope of the budget line? **(5 marks)**

4) Answer the following questions:

a. Show with the isoquant –Isocost apparatus, a firm is in equilibrium with regard to the use of factors when the ratios when the ratios of marginal products are equal to the ratios of input prices. **(10 marks)**

b. Distinguish between economic cost and accounting costs. Which should be taken into account for calculating the economic profits of the firm? **(5 marks)**

c. Suppose that revenue and total costs of a firm are given by the equations; $R= 60Q$ and $C=10+5Q^2$. What is the profit maximizing output and total profit of the firm? **(5 marks)**

5) A perfectly competitive firm has the following total cost function

Output	**Total cost**
0	20
1	30
2	42
3	55
4	69
5	84
6	100
7	117

a. How much will the firm produce if the price of the product in the market is K14? **(5 marks)**

b. How will it change its output if price rises to K16 per unit? **(5 marks)**

c. What is a cartel? Explain how a cartel determines price and out of a product to maximise joint profits. **(10 marks)**

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

MID-YEAR EXAMINATIONS—2017/18 ACADEMIC YEAR

COURSE NAME: INTERMEDIATE MICROECONOMICS

COURSE CODE: AGE 3031

DATE: 13TH JULY 2018

DURATION: THREE HOURS

TOTAL MARKS: 100

INSTRUCTIONS:

1. Answer all five (5) questions in this examination paper.

2. Answer questions 1 to 3 in a separate answer booklet and questions 4 and 5 in another answer booklet. If at all you need more booklets to complete answering the questions, the booklets for questions 1 to 3 should be tied together and do the same for questions 4 and 5.

3. Write legibly and show your work as you attempt each question.

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1. For each of the following four statements below, state whether the situation described is **TRUE** or **FALSE**. To get full credit, please provide a logical and well-argued explanation to justify your choice of answer.

   a) A monopolist has a constant marginal cost of 1. Suppose the inverse demand curve faced by the monopolist is $P = 5 - 0.05Q$, his profit-maximising price and quantity will be 3 and 40 respectively. **(5 marks)**

   b) A consumer's utility for goods X and Y is represented as $u = \min(10X, Y)$. If the prices of the two goods are $P_X = P_Y = 1$ and income is $I = 110$ her utility maximising bundle will be $X = 10$ and $Y = 1$. **(5 marks)**

   c) The concepts of marginal rate of substitution (MRS) and marginal rate of technical substitution (MRTS) are one and the same thing. **(5 marks)**

   d) The elasticity of substitution of a Leontief production function is zero. **(5 marks)**

2. J. Fire's preferences over consumption bundles of two goods (X, Y) are summarised by the following utility function:

$$u = 16X - 2X^2 + 4Y$$

   Let P_X and P_Y be the prices of goods X and Y respectively and I be J. Fire's income. Assuming he maximizes utility subject to his budget constraint:

   a) Derive his Marshallian demand functions for X and Y. **(8 marks)**

   b) Based on the derived Marshallian demands in part a), does an increase in income have any effect on the quantity demanded of each good? Explain and show your work. **(6 marks)**

   c) Based on the derived Marshallian demands in part a), does an increase in income and prices of both goods by the same proportional amount of 50% have any effect on the quantity demanded of each good? Explain and show your work. **(6 marks)**

3. An agribusiness firm plans to produce tractor rippers using the technology:

$$q = KL$$

   where K is capital measured in machine-hours, L is labour measured in person-hours and q denotes rippers produced per year. The hourly wage rate $w = 10$ and the hourly rental rate of capital is $r = 20$:

   a) Does the technology for producing tractor rippers display increasing, constant or decreasing returns to scale? Show your work. **(3 marks)**

   b) Compute the marginal physical products of L and K and interpret your results. **(5 marks)**

   c) Assuming the firm operates rationally (minimises costs), what will be the optimal levels of L and K that will be required to supply 20,000 rippers per year? **(12 marks)**

4. Assume a simple pure exchange economy with two agents; A and B and two goods; *X* and *Y*. Further, the utility functions for the two agents are as follows:

$$U^A = (20 - 0.125X_A)X_A + Y_A$$

$$U^B = (20 - 0.1X_B)X_B + Y_B$$

In addition, the initial endowments of good X and Y are as follows:

$$w_X^A = 80 \quad , w_Y^A = 50$$

$$w_X^B = 10, \quad w_Y^B = 500$$

a. Derive each consumer's demand function for both good *X* and *Y*. **(8 marks)**

b. Compute the general equilibrium price ratio in this economy. **(4 marks)**

c. How much of good *X* and *Y* do consumer A and B buy, sell, and consume in the equilibrium? **(4 marks)**

d. Use an appropriate diagram to depict the situation after trade. **(4 marks)**

5. Suppose that the production of good X imposes external costs on goods produced by third parties.

i. Define an externality. **(2 marks)**

ii. Illustrate how such an externality can best be solved. **(8 marks)**

iii. What is pareto improvement? **(2 marks)**

iv. What do you understand by market failures? **(3 marks)**

v. State the Walras' law as used in general equilibrium **(5 marks)**

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

THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS—2019/20 ACADEMIC YEAR

AGE 3031
INTERMEDIATE MICROECONOMICS

TIME: 1 HR 30 MINS MARKS: 60

INSTRUCTIONS:

1. **ANSWER ALL QUESTIONS AND WRITE LEGIBLY**
2. **ANSWER QUESTIONS 1 AND 2 IN ONE ANSWER BOOKLET AND 3 AND 4 IN A SEPARATE BOOKLET.**

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1. A consumer's preferences over consumption bundles of two goods (X, Y) are summarised by the following utility function:

$$u(X, Y) = XY + 3X + Y$$

Let P_X and P_Y be the prices of goods X and Y respectively and M be the consumer's income. Assuming the consumer maximizes utility subject to their budget constraint:

a) Derive the consumer's Marshallian demand functions for X and Y. **[16 marks]**

b) Are the Marshallian demands of X and Y increasing or decreasing functions of income? Explain and show your work. **[4 marks]**

2. An agribusiness firm plans to produce tractor rippers using the following production function:

$$q = KL$$

where K is capital measured in machine-hours, L is labour measured in person-hours and q denotes rippers produced per year. The hourly wage rate of labour is $w = ZMW\ 100$ and the hourly rental rate of capital is $r = ZMW\ 200$ (ZMW stands for Zambian Kwacha). Suppose the firm is targeting to produce 20,000 rippers in a year:

a) Set up the cost minimization problem and compute the optimal levels of K and L required to produce the target number of rippers at the given wage and rental rates. **[16 marks]**

b) Compute the firm's marginal cost of producing rippers. Interpret the marginal cost that you have computed. **[4 marks]**

3. Imagine that coffee and tea, considered by consumers as substitutes, are grown in two different parts of Zambia with different weather patterns. Suppose that harsh weather conditions in the coffee production region result into low yields of coffee in season 2 as shown by the final supply curves column in the table below. Assuming that the demand curves for both coffee and tea remain unchanged in both farming seasons, and that the supply curve of tea also remains the same in both farming seasons.

Markets	Demand Curves	Season 1 Supply Curves	Season 2 Supply Curves
Coffee	$Q_C = 120 - 50P_C + 40P_T$	$Q_C = 80 + 20P_C$	$Q_C = 40 + 20P_C$
Tea	$Q_T = 80 - 75P_T + 20P_C$	$Q_T = 45 + 10\,P_T$	$Q_T = 45 + 10\,P_T$

Using the information above:

a) Calculate the general equilibrium prices of coffee and tea in season 1. **[5 marks]**

b) What will be the general equilibrium prices of coffee and tea after the harsh weather conditions during season 2? **[5 marks]**

4. As with other goods, a public good should be provided as long as the marginal benefit of an additional unit of that good is at least as great as the marginal cost of that unit. Further, we also know that marginal social benefits are equal to the total willingness to pay (WTP) for the goods under demand. Given the two demand curves below written in inverse form, with price on the left and quantity of the right, answer the questions that follow:

$$D_1;\ P_1 = 100 - Q$$

$$D_2;\ P_2 = 200 - Q$$

a) Calculate the efficient level of production if the marginal cost of producing the public good is $ZMW\ 240$. **[5 marks]**

b) Calculate the efficient level of production if the marginal cost of producing the public good reduces to $ZMW\ 50$. **[5 marks]**

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

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – DEFERED 2020

AGE 3301

INTRODUCTORY MATHEMATICS FOR ECONOMISTS

TIME: 1 Hour 30 Minutes Marks:60

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

1. **[20 Marks]** Answer the following questions with respect to economics and its links to mathematics
   a) In a sentence or two, why is economics sometimes used to study the following economic agents?
      i. Households
      ii. Firms
      iii. Government agencies
   b) Economists follow a two-step process to analyze almost any economic problem. List the two steps discussed in class.
   c) Mathematical economics can be used to predict the effect of increasing the price of mealie meal on demand. True or False?
   d) If the domain of the function $y = 5 + 3x$ is the set $\{x \mid 1 \leq x \leq 9\}$, find the range of the function and express it as a set.
   e) Given the sets $S_1 = \{8,5,7\}$, $S_2 = \{9,2,7\}$, $S_3 = \{5,8,7\}$ and $S_4 = \{5,8\}$, which of the following statements are True? And which are False?
      a) $S_1 = S_3$
      b) $S_1 = R$ (set of real numbers)
      c) $8 \in S_2$
      d) $3 \notin S_2$
      e) $4 \notin S_3$
      f) $S_4 \subset R$
      g) $S_1 \supset S_4$
      h) Null set $\subset S_2$
      i) $S_3 \supset \{1,2\}$
      j) $4 \notin S_2$
2. **[5 Marks]** Differentiate the following functions with respect to x,
   a) $(9x^2 - 2)(3x - 1)$
   b) $y = u^2 + 3u$ where $u = 4 - 2x^2$
3. **[15 Marks]** A firm's average revenue function is given as $60 - 3Q$,
   a) Find the total revenue function
   b) Find the marginal function
   c) At what level of output will the firm's total revenue be at a maximum?

4. **[20 Marks]** The demand and supply functions of a two commodity market model are as follows:

$$Q_{d1} = 12 - 3P_1 + P_2$$
$$Q_{s1} = -3 + 4P_1$$
$$Q_{d2} = 9 + P_1 - 2P_2$$
$$Q_{s2} = -2 + 3P_2$$

a) Write the market model in matrix form

b) Solve the commodity market model for P_1 and P_2.

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

The University of Zambia
School of Agricultural Sciences
University First Half Examinations – July 2018

AGE 3301
Introductory Mathematics for Economists

Time: Three (3) hours

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

1. Answer the following questions with respect to economics and its links to mathematics
   a. List four reasons why we study economics, as discussed in class. (4 points)
   b. Why is economics sometimes used to study the following economic agents? (6 points)
      i. Households
      ii. Firms
      iii. Government agencies
   c. Economists follow a *two-step process* to analyze almost any economic problem. List the two steps discussed in class. (4 points)
   d. In economic modeling both theory and observations are required. Explain (4 points)
   e. Economic models can be built with words, diagrams and/or mathematical statements. True or False? (2 points)
   f. Explain how you would choose the level of complexity for your model. (2 points)

2. Answer the following questions on matrix algebra

   a. Solve the system $Ax = b$, given (6 points)

$$A = \begin{pmatrix} 0 & 2 & 3 \\ 2 & -1 & -1 \\ 1 & 3 & 4 \end{pmatrix}, \text{ and } b = \begin{pmatrix} 5 \\ 1 \\ 6 \end{pmatrix}$$

   b. Find the unknown matrix **X** from the equations (4 points)

$$\begin{pmatrix} 1 & 2 \\ 2 & 5 \end{pmatrix}\mathbf{X} = \begin{pmatrix} 4 & -6 \\ 2 & 1 \end{pmatrix}$$

   c. Can the following system of equations be solved with matrix algebra? Explain your answer. (4 points)

$$2x + y - z = 3$$
$$3x + 3y + 2z = 7$$
$$7x + 5y = 13$$

3. Given the sets $S_1 = \{2,4,6\}$, $S_2 = \{7,2,6\}$, $S_3 = \{4,2,6\}$, and $S_4 = \{2,4\}$, which of the following statements are True? And which are False? (10 points)

a) $S_1 = S_3$
b) $S_1 = R$ (set of real numbers)
c) $8 \in S_2$
d) $3 \notin S_2$
e) $4 \notin S_3$
f) $S_4 \subset R$
g) $S_1 \supset S_4$
h) Null set $\subset S_2$
i) $S_3 \supset \{1,2\}$
j) $4 \notin S_2$

4. Given $S_1 = \{3,6,9\}$, $S_2 = \{a,b\}$, $S_3 = \{m,n\}$, find the following Cartesian products (6 points)

a) $S_1 \text{x} S_2$
b) $S_2 \text{x} S_3$
c) $S_3 \text{x} S_1$

5. If the domain of the function $y = 5 + 3x$ is the set $\{x \mid 1 \leq x \leq 9\}$, find the range of the function and express it as a set. (8 points)

The University of Zambia
School of Agricultural Sciences
University First Half Examinations – July 2018

AGE 3381
Research methodology

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

1. Answer the following questions about research.

   i) For each of the following statements, indicate whether it is True or False. [11 points]
      a) Research is a systematic approach to obtaining and confirming new and reliable knowledge
      b) Research aims to determine the truth
      c) Accidental discovery is not research
      d) Collecting data for analysis is by itself research
      e) Research is circular, creative and does not need to be planned
      f) Descriptive research aims to establish why something occurs or how it came to be
      g) Analytic research aims to determine, describe or identify something
      h) Problem-solving research is generally the most durable
      i) Compared to physical sciences, social sciences place more emphasis on use of theories
      j) Observational data are generally less reliable than experimental data
      k) Research needs both deductive and inductive logic because each is by itself not fallible

   ii) For each of the following statements, indicate whether it is Correct Deductive Logic (CDL), Wrong Deductive Logic (WDL), Correct Inductive Logic (CIL), or Wrong Inductive Logic (WIL). [4 points]
      a) All men are mortal. Daniel is a man. Therefore, Daniel is mortal
      b) Every fish has gills. All sharks are fish. Therefore, every shark has gills
      c) All birds can fly. A bat can fly. Therefore, a bat is a bird
      d) Every shark ever observed has gills. Therefore, every shark has gills

2. Answer the following questions on sample size determination. [10 points]

   i) The net sample size (n) when estimating a proportion with a simple random sampling (SRS) without replacement is given by:

$$n_i = \frac{z^2_{\alpha/2}\left(\hat{p}(1-\hat{p})\right)}{\varepsilon^2},$$

   where $\hat{p}$ = 0.07, Z = 1.96, and ε = 0.05. Compute the optimal SRS sample size.

   ii) Suppose the individual response rate is 98%. Compute the response-rate-adjusted sample size.

3. Suppose you have a population of 12 students (N) and would like to randomly select 3 (n) students.

   a) How many possible samples are you faced with? [4 points]
   b) What is the implication of the fact that there are so many possible samples on the way you report your statistics? [5 points]
   c) As long as computations are based on a randomly selected subset of the population, the researcher needs to be cognizant of four levels of randomness. List and explain the four levels. [8 points]
   d) Suppose X is normally distributed with population mean 4 and variance 16. What is the distribution of the sample mean, $\overline{X}$? [3 points]

4. Read the following excerpt from the introduction of a recently published journal article (Tembo et al. 2014) and answer the questions that follow.

Childhood undernutrition in sub-Saharan Africa is a public health crisis. Although hundreds of programs aim to improve agriculture in areas of high malnutrition, relatively few are deliberately nutrition-sensitive, for example specifying improved nutrition as an explicit goal or incorporating particular components related to nutrition (Berti et al. 2004; Arimond et al. 2011; Stewart et al. 2015; Pandey et al. 2016). Moreover, most studies of those that are explicitly nutrition-sensitive have been limited by their methodology (Masset et al. 2011; Girard et al. 2012), with low internal validity and limited measurement of relevant outcomes (Webb and Kennedy 2014) so that much of the evidence of their impact on nutrition has been inconclusive (Ruel and Alderman 2013; Ruel et al. 2017). Nevertheless, there is an emerging body of rigorous research along the pathways from agriculture to nutrition in low-income settings, including: increased household production of, and access to, nutritious foods; improvements in the status of women in agricultural households; improved diets and nutrient intakes of household members; and improvements in aspects of nutritional status (Leroy et al. 2008; Olney et al. 2009; Carletto et al. 2015; de Brauw et al. 2015; Dillon and McGee 2015; Slavcheska 2015; Hoddinott et al. 2015; Azzarri et al. 2015;). We add to this literature by examining the effects of a nutrition-sensitive agricultural program implemented in rural Zambia (Harris et al. 2011), with a focus on pathways through agriculture, food security and dietary diversity. The program included several components designed to improve three aspects hypothesized together to contribute to improved nutrition: diversity in household agricultural production; women's input into household, agricultural and child feeding decisions; and women's nutritional knowledge.

Our paper contributes to the literature in two ways. First, we provide new evidence on the effects of a nutrition-sensitive agricultural program offered at scale for four years to households in a small geographic region in rural Zambia. Second, we take a comprehensive approach examining effects along the nutrition-sensitive agricultural program impact pathways, including agricultural production, sales and consumption from own production, household food access, and maternal and child diets.

In not more than three sentences,

a) What is the specific research problem addressed by this paper? [5 points]
b) State the overall and specific objectives of the study. [5 points]
c) What is the rationale for the study? [5 points]

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2017/2018 ACADEMIC YEAR - TERM ONE FINAL EXAMINATION
JULY 2018
AGE 4131: PRODUCTION ECONOMICS

TIME: THREE (3) HOURS
INSTRUCTIONS: ANSWER ANY FOUR OF THE FIVE QUESTIONS. EACH ONE IS WORTH 25%.

Question One

a. In the production process of any agricultural commodity, the only change in total costs possible is the change in variable costs. Is this true or false? Explain. (5 marks)
b. For the production function $Y = 0.5X^{\beta}$
   i. Prove that β is the elasticity of production. (5 marks)
   ii. If $\beta = 1/2$, what are the MPP and APP when X= 4, 9, 16 and 25. (5 marks)
c. State the law of Diminishing Returns. (2.5 marks)
d. State the law of Diminishing Marginal Returns (2.5 marks)
e. What are the cost implications to a potato farmer who decides to defy the law of diminishing returns? (5 marks)

Question Two

a. What are the assumptions of a purely competitive market? Explain them briefly and give examples where possible (5 marks)
a. Why are these assumptions important in the study of Production Economics? (5 marks)
b. Draw and fully label the Classical Production Function, the Average Physical Product (APP) and Marginal Physical Product (MPP) Curves. In your drawing, carefully label the three stages of the production function and the elasticity of production in each stage (5 marks). Alongside your well labelled diagram, provide a brief description of each stage with reference to the Total Physical Product (TPP), MPP, APP, Elasticities of production and the economic relevance of each stage (10 marks).

Question Three

a. Define the following and provide a well labelled graphical illustration
   i. Isoquant (5 marks)
   ii. Iso cost line (5 marks)
   iii. Isocline (5 marks)
   iv. Expansion path (5 marks)
b. For the production function, $Y = 10X_1^{1/2}X_2^{2}$ find the isocline equation. (5marks)

Question Four

Derive and provide a well labelled graphical illustration of the least cost combination criteria. (20 marks)

Question Five

Why is the concept/application of compounding and discounting important to an agribusiness? (10 marks)
Concerning durable inputs, what is the main difference between leasing and hiring? (10 marks)
What is a sinking fund? What does it mean when a firm does not have a sinking fund? (5 marks)

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2017/18 ACADEMIC YEAR MID YEAR EXAMINATIONS
AGE 4211: INTRODUCTION TO AGRIBUSINESS MANAGEMENT
TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER **ALL** QUESTIONS

Question 1

Zamgold sells vegetable cooking oil in retail outlets throughout the country. Over the last two years it has experienced declining profitability and is wondering if this is related to the sector as whole. It has recently subscribed to an agency that produces average ratios across many businesses. Below are the ratios that have been provided by the agency for the cooking oil business sector based on a year end of 30 June 2017.

Return on year-end capital employed (ROCE)	16.8%
Gross profit margin	35%
Operating profit margin	12 %
Current ratio	1.25:1
Average inventory turnover	3 times
Debt to equity	38%

The financial statement for Zamgold for the year ended 30 September 2017 are:

Income statement

	ZMW' 000	**ZMW' 000**
Revenue		56,000
Opening inventory	8,300	
Purchases	43,900	
	52,200	
Closing inventory	(10,200)	(42,000)
Gross profit		14,000
Operating costs		(9,800)
Finance costs		(800)
Profit before tax		3,400
Income tax expenses		(1,000)
Profit for the year		2400

Balance sheet

	ZMW' 000	ZMW' 000
Assets		
Fixed assets		
Farm buildings & structures		25,600
Deferred development expenditure		5,000
		30,600
Current assets		
Inventory	10,200	
Cash in bank	1,000	11,200
Total assets		41,800
Equity and Liabilities		
Equity		
Equity shares of ZMW 1 each		15,000
Property revaluation reserve		3,000
Retained earnings		8,600
		26,600
Long term liabilities		
Loan		8000
Current Liabilities		
Trade payables	5400	
Current tax payable	1800	7200
Total equity and liabilities		41,800

N:B The deferred development expenditure relates to an investment of installing an irrigation system in the future.

Required

(a) Prepare for Zamgold the equivalent ratios that have been provided by the agency **(12 Marks)**

(b) Assess the financial and operating performance of Zamgold in comparison to its sector averages **(13 Marks)**

Question 2

Use the particulars highlighted below for ABC Ltd to calculate the break-even point in terms of: Variable Costs per unit = 15ZMW; Fixed Costs = 72,000ZMW, selling price per unit = 24ZMW

(a) Sales and value in units **(5 Marks)**

(b) The number of units that must be sold to earn a profit of ZMW 90,000 **(3 Marks)**

(c) Evaluate the usefulness of break-even analysis to management of ABC Ltd **(12 Marks)**

(d) Briefly discuss five major challenges posed to management of agribusinesses by the special nature of agricultural products **(5 Marks)**

Question 3

Discuss factors that influence the choice of the best form of business organization suitable for an agribusiness. Use Sole proprietorship and Corporations as examples, and in the process contrast the two forms of business organization **(25 Marks)**

Question 4

a) Outline Maslow's hierarchy of needs and its relevance to agribusiness managers **(10 Marks)**

b) Argue out the case of human resources being the most important resource for the agribusiness enterprise **(5 Marks)**

c) Job satisfaction is one of the most important factors that motivate people at work. Evaluate this statement and with the aid of examples, highlight *four other* motivating factors **(10 Marks)**

THE END

THE UNIVERSITY OF ZAMBIA

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

AGE 4351 BASIC ECONOMETRICS MID YEAR EXAMINATION 2018

INSTRUCTIONS: THERE ARE FOUR QUESTIONS IN THIS TEST: ANSWER ALL

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS, 100 MARKS

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1. You want to find out how labour (X1) and capital (X2) affected copper (Y) production at ZCCM between 2010 and 2013. Using you production economics theory you know that the inputs and outputs are related in a Cobb-Douglas fashion (whose output is given below):

$$Y = -3.338 X_1^{1.4988}, X_2^{0.4899}$$

R-squared = 0.889, t value for labour coefficient (B1) = 2.7765, t-value for capital coefficient (B2) = 4.8005

a) With respect to the period under consideration can you interpret what the elasticity of labour demand for ZCCM was? (4 marks)
b) Between labour and capital, which input gave a higher output, explain? (6 marks)
c) Explain what the R-squared entails? (4 marks)
d) Formulate the null hypothesis for testing whether labour significantly affected production. (2 marks)
e) Given the t critical at 95% confidence level of 2.174, test the Ho formulated in (e) and interpret? (4 marks)
f) Calculate returns to scale and explain whether or not ZCCM experienced constant return to scale during the period under consideration (5 marks)

2. Suppose you want to know the relationship between sales of Kapenta (Y) and advertisement Cost (X), both measured in Zambian Kwacha. You make the following data observations.

X	150	175	200	225	250	275	300	325	350	375
Y	18	24	26	23	30	27	34	35	33	40

a) Use the ordinary least squares (OLS) method to estimate the relationship between Kapenta sales (Y) and advertisement costs (X) (10 marks)
b) Write down the Kapenta sales, advertisement cost function and interpret it (5 marks)
c) Test the null hypothesis that $H_0 : \beta_1 = 0$ at $\alpha = 0.05$ where t-critical = +/-1.96 (5 marks)
d) Compute R squared and interpret (5 marks)

3. After estimating the following Mincer equation which links earnings (E) to years of schooling (S) and experience (EX), and gender (G):

$$Ln\,(E_i) = \beta_0 + \beta_1 S_i + \beta_2 EX_i + \beta_3 EX_i^2 + \beta_4 G_i + \beta_5 G_i\, S_i + \beta_6 G_i\, EX_i + e_i$$

You get the following output:

	Estimated coefficient	Standard error	t-statistic
Gender (1 = female, 0 = male)	-0.308	0.142	-2.170
Schooling in years	0.092	0.006	14.260
Gender & Schooling interaction	0.012	0.010	1.220
Experience in years	0.044	0.004	10.710
Experience squared in years	-0.001	0.000	-7.280
Gender & experience interaction	-0.005	0.002	-2.340
Constant	0.760	0.098	7.790

a) Do earnings increase with the levels of experience and schooling? Explain (5 Marks)

b) What does the negative coefficient on experience-squared entail? (5 Marks)

c) Which variable(s) have no significant effect on earnings? (2 Marks)

d) What is the effect of an additional year of experience on earnings? (6 Marks)

e) Are the earnings of females the same as those for males? Explain (7 Marks)

4. Answer in a clear way, the following questions:

a) Explain (*not necessarily defining*) what **autocorrelation** mean (6 marks)

b) Explain how you would conduct the **Durbin-Watson (DW) test** for auto correlation (8 Marks)

c) What is the major weakness of the **Durbin-Watson (DW) test?** (4 marks)

d) Explain **any other test** you would use to detect **autocorrelation** in a model (7 marks)

GOOD LUCK!

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

MID-YEAR EXAMINATIONS—2017/18 ACADEMIC YEAR

COURSE NAME: INTERNATIONAL AGRICULTURAL MARKETS, TRADE AND DEVELOPMENT

COURSE CODE: AGE 5151

DATE: 3RD JULY 2018

DURATION: THREE HOURS

TOTAL POINTS: 100

INSTRUCTIONS:

1. This examination paper has two sections. Section A has twenty-five (25) multiple-choice questions and Section B has three (3) open ended questions. Answer all questions from both sections.
2. Clearly show your work in your answers to Section B questions.
3. Please be concise in answering the questions and write legibly.

SECTION A (25 points – 1 point each)

1. Which of the following is not a very good explanation for why nations trade?
   A. It enables consumers in the importing country to have a larger and more diverse bundle of goods and services available at lower overall prices
   B. The World Trade Organization (WTO) mandates that nations should trade
   C. The existence of comparative advantage produces an area of potential trade within which both countries can make better deals for themselves through international exchange than by adjusting its own resources internally
   D. There are economy-wide gains from trade both from an exchange of goods and from the ability to specialize in production

2. "Zambia should promote exports and substantially minimise imports in order to create trade surplus." Which school of thought would you attribute this statement?
   A. Humanism
   B. Mercantilism
   C. Capitalism
   D. Socialism

3. Which of the following is not true about the Ricardian model?
   A. It assumes perfect competition
   B. It assumes that there is only one factor of production, capital
   C. It is a partial equilibrium model
   D. Both B and C

Use the following table to answer questions 4 – 6. Suppose that labour can produce flowers or chocolate in country A and B. Below is the table that indicates the labour productivities in each country.

	Flowers	Chocolate
Country A	20 units/hour	120 units/hour
Country B	10 units/hour	30 units/hour

4. Which of the following is true?
   A. Country A has an absolute advantage in flowers
   B. Country B has a comparative advantage in flowers
   C. Country B has a comparative advantage in chocolate
   D. Both A and B

5. Both countries would benefit if
   A. Country A produced both commodities and did not trade with Country B
   B. Country B produced both commodities and did not trade with Country A
   C. Country A exported chocolate and imported flowers
   D. Country A exported flowers and imported chocolate

6. Which workers would experience an increase in real wages if the two countries specialized in their respective comparative advantage good and traded freely?
   A. Workers in Country A's chocolate industry
   B. Workers in Country A's flower industry
   C. Workers in Country B's chocolate industry
   D. None of the workers

7. What theory of trade is appropriate to explain trade between countries with similar resource endowments?
   A. Ricardian Model
   B. Absolute advantage theory
   C. H-O model
   D. Economies of scale in production

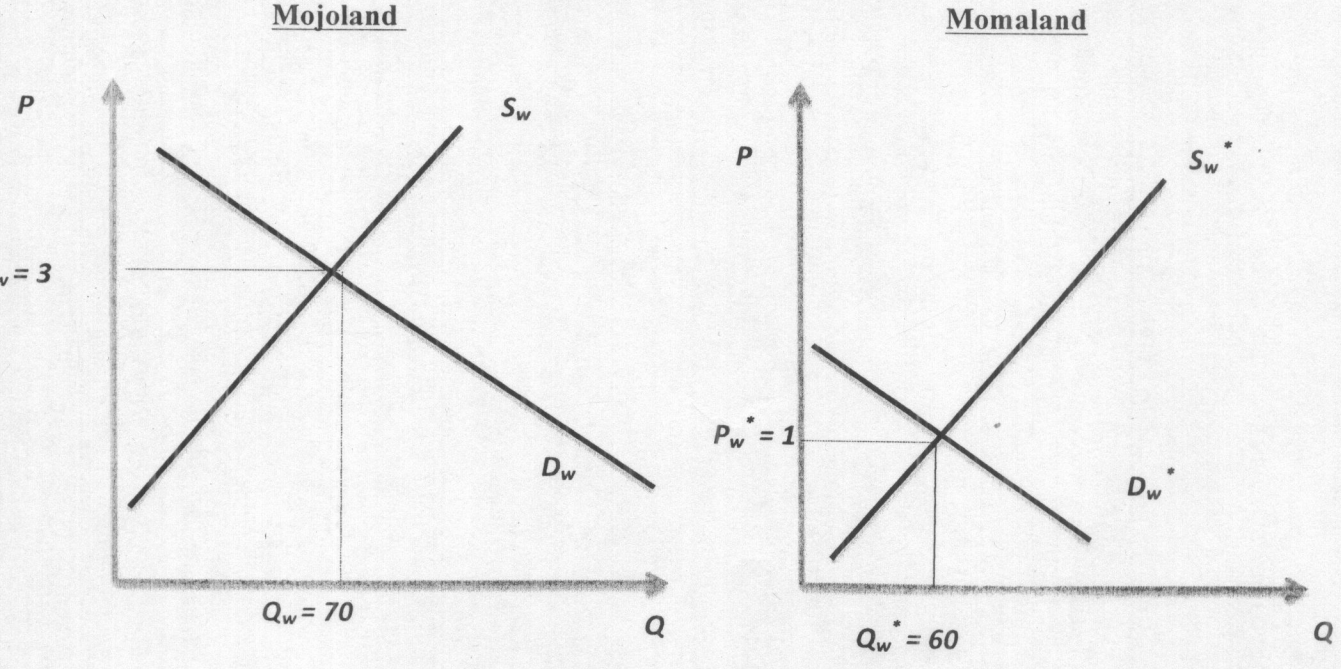
8. The theorem of the H-O model that states that if the price of the labour-intensive good rises then the price of labour will rise while the rental rate paid to capital will fall is called the:
   A. Heckscher-Ohlin theorem
   B. Stolper-Samuelson theorem
   C. Rybczynski theorem
   D. Factor-Price Equalisation theorem

9. If Zambia is labour abundant, based on the H-O model, the group that would gain from trade is:
   A. Capitalists
   B. Workers
   C. Both groups would gain
   D. No losers or gainers

10. The general version of the Rybczynski theorem is called the
   A. Magnification effect for quantities
   B. Magnification effect for prices
   C. Factor-price equalization theorem
   D. H-O model

11. When economists say trade is not a zero sum game, they mean that
   A. The sum of the gains to the winners is exactly equal to the sum of the losses to the losers
   B. The sum of the gains to the winners is less than the sum of the losses to the losers
   C. The sum of the gains to the winners is greater than the sum of the losses to the losers
   D. Countries are able to retaliate or engage in trade wars

Answer questions 12 – 13 by referring to the demand and supply of wheat for two trading partners



12. What is not true based on the information presented on these graphs?
    A. Mojoland will import wheat from Momaland in free trade
    B. Momaland will export wheat to Mojoland in free trade
    C. The free trade equilibrium price of wheat will be less than 1
    D. The free trade equilibrium price of wheat will lie between 1 and 3

13. What do the quantities 70 and 60 represent?
    A. Equilibrium quantities in free trade
    B. Equilibrium quantities in autarky
    C. 70 is the equilibrium quantity in free trade and 60 is the equilibrium in autarky
    D. 70 is the equilibrium quantity in free autarky and 60 is the equilibrium in free trade

Answer questions 14 – 16 by referring to the following trade policy game between two countries.

	(USA, Japan)	Japan	
		Free Trade	Optimal Tariffs
USA	Free Trade	(200, 200)	(140, 240)
	Optimal Tariffs	(240, 140)	(180, 180)

14. Assuming the two countries seek to optimise national welfare, would Japan retaliate if the USA decided to impose optimal tariffs?
    A. No, Japan would choose free trade
    B. No, Japan would choose not to play any of the available strategies
    C. Yes, Japan would choose optimal tariffs
    D. None of the above

15. Assuming the two countries seek to optimise national welfare, what would be Japan's best response strategy if the USA decided to go for free trade?
    A. Japan would choose free trade
    B. Japan would choose not to play any of the available strategies
    C. Japan would choose optimal tariffs
    D. Japan would be indifferent (they could choose free trade or optimal tariffs)

16. Does the outcome of this game as depicted by your answers to question 14 and 15 help justify a trade liberalization organization like the World Trade Organization?
    A. Yes
    B. No
    C. It depends on the size of the two countries in global markets
    D. It depends on the frequency of trade between the two countries

17. A government might want to devalue its currency if
    A. Exporters have a strong lobbying arm
    B. Import buyers have a strong lobbying arm
    C. Policymakers worry about high domestic inflation rates
    D. Foreign governments tell it not to

18. Dumping occurs when a firm
    A. Sells too much of a good in a foreign country
    B. Sells in a foreign country at prices that are below fair value
    C. Sells in its home market at prices that are below the average price charged by its competitors
    D. Sells in a foreign market at prices that are below the prices charged by firms based in that market

19. Which of the following statements is **FALSE**?
    A. Zambian imports of South African oranges will create a demand for the South African Rand
    B. If all Zambians decide to buy Indian Basmati rice, the Kwacha will appreciate relative to the Indian Rupee
    C. A change from K10.50/$ to K9.67/$ represents an appreciation of the Kwacha
    D. The exchange rate is kept the same in all parts of the market by exchange arbitrage

Use the economic data for a fictional country Sandia to answer questions 17-20.

Sandia Economic Data (billions)	
Gross Domestic Product	$ 400
Imports of Goods and Services	$ 140
Investment Spending	$ 20
Private Saving	$ 30
Exports of Goods and Services	$ 100
Government Transfers	$ 40
Government Tax Revenues	$ 140
Government Spending	$ 140
Consumption Spending	$ 280

20. Based on the data, Sandia has a current account
    A. Deficit
    B. Surplus
    C. Of Zero
    D. That cannot be determined

21. Based on the data, Sandia has a government budget balance
    A. Deficit
    B. Surplus
    C. Of Zero
    D. That cannot be determined

22. Does Sandia's data satisfy the national income identity?
    A. Yes
    B. No
    C. We have less information to verify this
    D. We have too much information to verify this

Use the information in the table below to answer question 23 - 25.

	Bread Price/loaf	Exchange Rate 23/10/2015
Zambia	ZMW 3.00	–
Botswana	BWP 4.95	0.55 ZMW/BWP
South Africa	ZAR 6.00	0.47 ZMW/ZAR

23. The purchasing power parity exchange rate between Botswana and Zambia based on the price of bread is
    A. 1.65 BWP/ZMW
    B. 1.65 ZMW/BWP
    C. 0.61 BWP/ZMW
    D. 1.82 BWP/ZMW

24. The purchasing power parity exchange rate between South Africa and Zambia based on the price of bread is
    A. 2.13 ZAR/ZMW
    B. 2.00 ZMW/ZAR
    C. 2.00 ZAR/ZMW
    D. 0.50 ZAR/ZMW

25. Based on the information in the table, the Kwacha is
    A. Undervalued relative to the BWP
    B. Undervalued relative to the ZAR
    C. Overvalued relative to the BWP but undervalued relative to the ZAR
    D. Overvalued relative to both currencies

SECTION B (75 points – 25 points each)

1. Consider the following data for a fictitious country, Mojoland.

	Cotton ginning productivity (tons/hour)	Meat processing productivity (tons/hour)	Resource endowments (hours)
Labour	$\frac{1}{3}$	$\frac{1}{2}$	L = 12000
Capital	1	$\frac{1}{2}$	K = 4800

a) Using the relevant theorem of the H-O model, show which industry will be Mojoland's exporting industry. Clearly state the theorem that you have used. **(5 points)**

b) Compute and graph the equilibrium output quantities for lint (cotton) and processed meat produced by Mojoland. **(8 points)**

c) Suppose Mojoland has a favourable immigration policy that increases the labour endowment from 12000 to 14000 person hours. What will be the equilibrium quantities for lint (cotton) and processed meat produced by Mojoland (assume here that the capital endowment and factor productivities remain unchanged)? Depict this new equilibrium on a separate graph. **(8 points)**

d) Briefly explain whether or not the change in equilibrium in part c) is consistent with the predictions of the Rybczynski Theorem. **(4 points)**

2. Country A is a "small" country in processed coffee markets. Domestic supply and demand curves in Country A are as follows:

$$S_C^A = 60 + 0.2\,P_C^A$$

$$D_C^A = 180 - 0.8\,P_C^A$$

where P_C^A is the price of processed coffee in \$/ton in Country A, and S_C^A and D_C^A are quantities in thousand tons. The price of processed coffee in Country B (representing the rest of the world) is \$100/ton.

a) If the two countries were freely trading, what would be the pattern of trade and the prevailing equilibrium price and quantity traded of processed coffee? Graph this equilibrium using the export supply and import demand diagram. **(8 points)**

b) Suppose Country A adopts the infant industry policy to support the domestic processed coffee industry. To support the industry, the Country A imposes a tariff of \$10/ton on imported processed coffee from Country B. Compute the welfare effects of this policy on all economic actors in Country A and Country B. Interpret your results and ensure to graph this tariff-ridden equilibrium on the domestic demand and supply diagram for Country A. **(12 points)**

c) After 10 years of the infant industry policy, Country A improves its efficiency in coffee processing demonstrated by the shift in the domestic supply to $S_C^A = 80 + 0.2\,P_C^A$. Assuming domestic demand remains the same and the price of coffee in Country B remains at \$100/ton, would you say the decision to protect the infant industry was justifiable? Explain your answer and show your work. **(5 points)**

3. This question focuses on exchange rate systems and models of exchange rate determination.

   a. Compare and contrast floating and fixed exchange rate systems. **(5 points)**

   b. For each of the **TWO** exogenous shocks/policy decisions outlined below, explain the effects on the following: (1) supply of Kwacha on the Zambian FOREX; (2) demand for Kwacha on the Zambian FOREX; (3) ZAR/ZMW spot exchange rate, and; (4) final adjustment of the relevant parity condition. Each exogenous shock/policy decision is characterised as a scenario. ***Be sure to first state the model of exchange rate determination you are applying to analyse each scenario. Ensure to provide graphical illustrations. Please note that ZAR and ZMW are abbreviations for the South African Rand and the Zambian Kwacha respectively.***

      i. **Scenario 1**: Key actors participating in the Zambian FOREX market expect that the ZAR/ZMW exchange rate will depreciate one year from today. **(10 points)**

      ii. **Scenario 2**: The Zambia government lifts the ban on importation of tomatoes originating from the low-priced South Africa market. **(10 points)**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2017/2018 MID-YEAR FINAL EXAMINATIONS
AGE 5251: AGRICULTURAL PROJECT PLANNING AND APPRAISAL
TIME: THREE HOURS
INSTRUCTIONS:

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

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1. a) Explain why technical and economic aspects are important in project preparation and analysis (6 marks)
   b) Are projects and programmes one and the same thing? Explain. (4 marks)
   c) Discuss briefly and depict by use of a diagram, the major stages of a project cycle. (10 marks)

2. a) What is the definition of a shadow price in economic analysis? (4 marks)
   b) Why are shadow prices important in economic analysis? (6 marks)
   c) Discuss briefly the relationship between shadow prices and opportunity cost (OC) as well as marginal value product (MVP). (10 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 ZKW' 000				
Year	Investment Outlay	Operation and maintenance	Production Cost	Gross Benefit
1	500	0	0	0
2	450	0	0	0
3	350	0	0	0
4	100	0	0	0
5	100	0	0	0
6	0	40	60	1000
7	0	40	70	1060
8	0	40	80	1120
9	0	40	90	1230
10	0	40	90	1280

a) Compute the Net Benefit-Investment (N/K) ratio if the opportunity cost of capital is 25%. 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 25% as the opportunity cost of capital, would you recommend the project as good investment? Explain why? (10 marks)
c) What advantages do discounted measures of project worth have over undiscounted measures of project worth? (4 marks)

4. The following information is given for a combine harvester to be imported into the country: the c.i.f. price is US$85,000; the import levy is 5% of the c.i.f. price; the handling and clearing charges amount to K12,000 and the transportation to the project site is K4,000. The official exchange rate (OER) is ZKW9.50 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)

5. The foreign exchange component and the domestic currency component of a layers' cages production project are as given in the following table:

	Foreign Exchange Component (US$ '000)			Domestic Currency Component (ZKW '000)	
Year	Value of Production	Investment Cost	Production Cost	Investment Cost	Production Cost
1	0	100	0	950	0
2	0	140	0	900	0
3	0	160	0	800	0
4	300	0	100	750	300
5	500	0	250	0	200
6	600	0	350	0	200
7	800	0	400	0	200
8	800	0	400	0	200
9	800	0	400	0	200
10	800	0	400	0	200

a) If the opportunity cost of capital is 25%, compute the domestic resource cost (DRC). If the official exchange rate (OER) is ZKW 9.50 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)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY MID-YEAR EXAMINATIONS JULY 2018

AGE 5321
AGRICULTURAL ORGANIZATION AND ADMINISTRATION

INSTRUCTIONS: ANSWER ALL QUESTIONS. EACH QUESTION IS WORTH 25%.

TIME: 3 HOURS

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1. Giving relevant examples, write brief notes explaining the following:
(a) The five (5) management functions in the management process. **[10 marks]**
(b) What are the **three** (3) skill areas that managers should possess and apply? You should also briefly comment on the skill mixtures needed by managers at various levels of management. [7 **marks]**
(c) The ten (10) roles which managers typically play. **[8 marks]**

2. (a) Explain and elaborate the major features of a bureaucratic organization as advanced or articulated by Max Weber **[10 marks]**
(b) Outline the disadvantages or limitations of bureaucratic organizations.**[5 marks]**
(c) Briefly outline the principles of administration as propounded by Henri Fayol. **[10 marks]**

3. (a) Explain Maslow's theory of human needs. Clearly elaborate the hierarchy of needs, the assumptions of the theory and how it operates as well as the major critiques of the theory. **[15 marks]**
(b) As a Manager of an extension programme in the Zambian Ministry of Agriculture, how would you apply Maslow's theory in motivating employees in the workplace? Cite relevant examples to illustrate your application. **[10 marks]**

4. (a) What is Human Resource Planning? Discuss in detail what is involved in human resource planning and briefly explain its relevance to the staffing function in management. **[10 marks].**
(b) What is Orientation? Expound on what is involved in this activity and its importance in terms of the staffing function **[8 marks].**
(c) Discipline is an important management duty. Outline the principles you would practice in maintaining discipline among subordinates in this agribusiness organization **[7 marks].**

[Total marks - 100]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY MID-YEAR EXAMINATIONS JUNE 2018

AGE 5451
ADVANCED ASPECTS OF RURAL SOCIOLOGY

INSTRUCTIONS: ANSWER ALL QUESTIONS. EACH QUESTION IS WORTH 25%.

TIME: 3 HOURS

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1. Most Sub-Saharan African countries have been experiencing challenges that negatively affect the performance of their rural and agricultural sectors.

   (a) Identify and elaborate on the main technical and institutional challenges faced by smallholder farmers in these African countries. **[15 Marks]**

   (b) Explain and highlight why market exchange in Africa is much more costly, cumbersome, time consuming and unpredictable than elsewhere. **[10 Marks]**

2. (a) What is development? What do you understand ***economic development*** to mean? Why is a strictly economic definition of development inadequate? Can you give hypothetical or real examples of situations in which a country may be developing economically but still be underdeveloped? **[10 Marks]**

   (b) What do you understand ***Sustainable Development*** to mean? What criteria would you use to decide whether or not Sustainable development was or was not taking place? **[15 Marks]**

3. In his seminal work, "Rural poverty unperceived", Chambers discusses the many biases that impede outsiders' contact with rural poverty. **Identify and briefly explain these biases**. Cite relevant examples to elaborate your answer. **[25 Marks]**

4. What do you understand **Sustainable Livelihoods** to mean? Identify and explain all the key components or issues that you should consider in analyzing rural livelihoods as proposed in the Sustainable Livelihoods (SL) Framework. Use a diagram to illustrate or help identify the components in the SL framework. **[25 Marks]**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

2017/18 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

AGF 2015
FUNDAMENTALS OF ORGANIC CHEMISTRY

Date: 13TH JULY, 2018
Time: 14:00 - 17:00 HRS
Venue:

Duration: THREE (3) HOURS

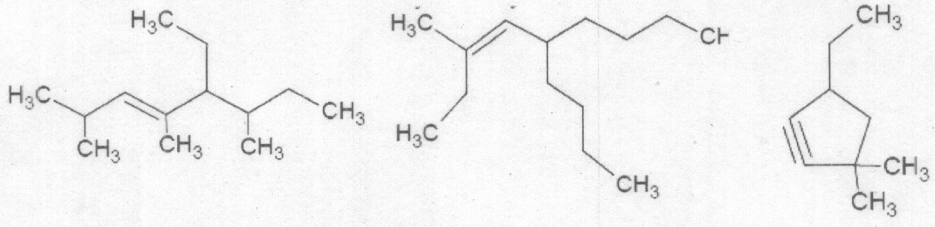
INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS A TOTAL OF FIVE (5) QUESTIONS.
2. EACH QUESTION CARRIES 20 MARKS.
3. ANSWER ANY FOUR (4) QUESTIONS.
4. USE ILLUSTRATIONS IN YOUR ANSWERS WHERE NECESSARY.

1.

a) Name the following compounds according to IUPAC nomenclature.

I. II. III.



(6 marks)

b) For each of the following, provide a complete structural formula showing all atoms and bonding electrons.

I. 1,2-diethyl-3,3-dimethylcyclopentane.

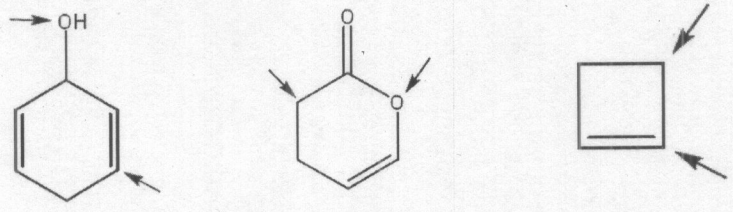
II. 5-ethyl-2,4,6-trimethyloct-3-ene.

III. 3-ethyl-5,5-dimethylcyclopent-1-yne.

(6 marks)

c) Determine the hybridization of the indicated atoms.

I. II. III.



(3 marks)

d) Draw all 5 of the isomers of hexane: C_6H_{14}. showing only the C atoms.

I. Identify all of the 1°, 2° and 3° carbons.

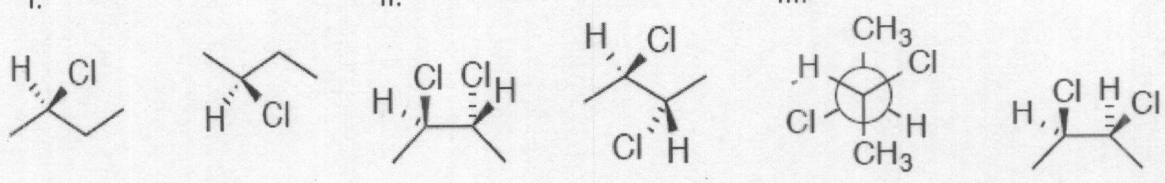
II. Which of these compounds would have the highest boiling point and the lowest boiling point.

(10 marks)

2.

a) Mark the relationships between the following pairs of structures as **either "same", "enantiomers"or "diastereomers"**

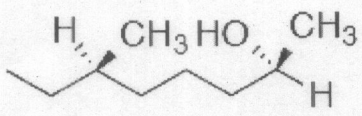
I. II. III.

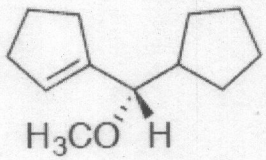


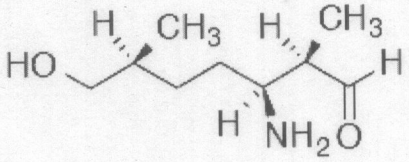
(6 marks)

b) Designate the R/S configuration for the chiral centers in the following molecules.

I. II. III.



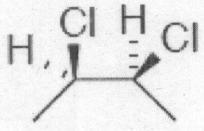


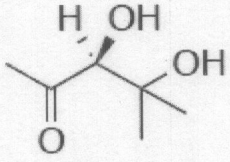


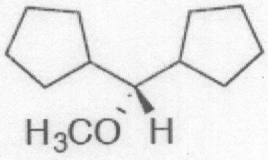
(6 marks)

c) Identify each of the following molecule as **chiral , achiral, meso** where it applies. (In other words, if it is achiral despite having chiral centers).

I. II. III.

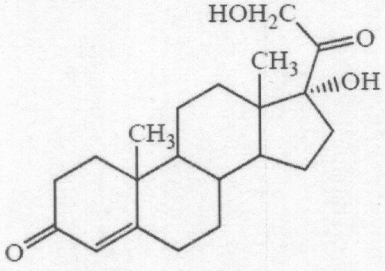






(3 marks)

d) How many chirality centers does the following structure contain? How many stereoisomers are possible for this structure theoretically?



(10 marks)

3.

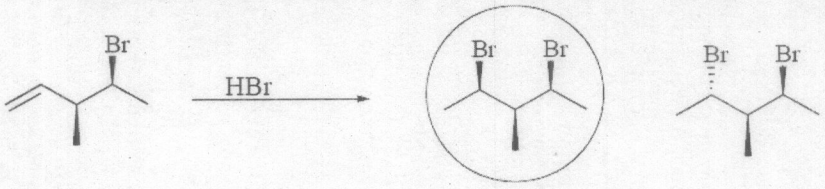
a) Describe the features and mechanism of operation of a Polarimeter in Organic chemistry (Use a sketch to illustrate your answer).

(5 marks)

b) Why is it necessary to separate a **Racemic mixture** of a lactic acid by reacting it with a **Chiral** base or an with an optically active reagent.

(6 marks)

c) Two stereoisomers are obtained from the reaction of HBr with (3S, 4S)-4-bromo-3-methyl-1-pentene. Explain why the compound in the circle is optically inactive.



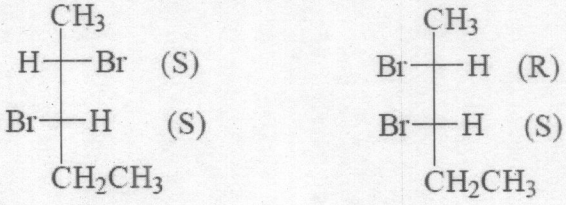
(6 marks)

d) A solution of an unknown compound **X** (3.0 g of **X** per 20 mL), when placed in a polarimeter tube 2.0 dm long, was found to have an observed rotation of –1.8°. What is the specific rotation of **X.**

(8 marks)

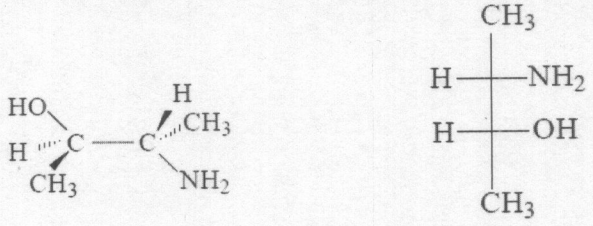
4.

a) Name the following compounds according to IUPAC nomenclature.



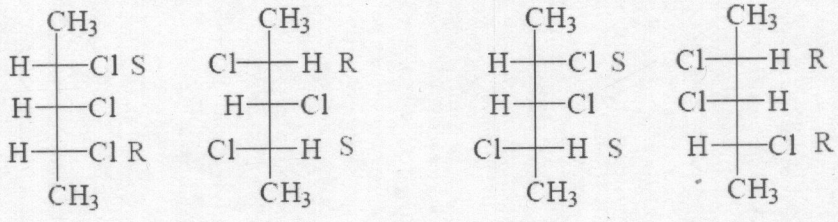
(3 marks)

b) Determine whether the following pairs of compounds are identical, enantiomers or diastereomers and give the absolute configuration (R or S) for each chiral center.



(6 marks)

c) Consider the Fischer projections of each stereoisomer for molecule 2,3,4-trichloropentane shown below. Indicate which of the stereoisomers are chiral and achiral.



(8 marks)

d) Consider the molecule 2,3,4-tribromohexane. Draw a Fischer projection with C_1 on top and $C_{4,5}$ at the bottom of the **2(S),3(S),4(R) stereoisomer**.

I. Draw the enantiomer of this stereoisomer.

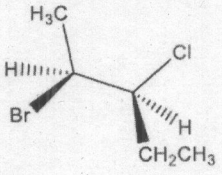
II. Draw two diastereomers for the same molecule (2,3,4-tribromohexane) that are not enantiomeric and give the absolute configurations of each chiral center.

(8 marks)

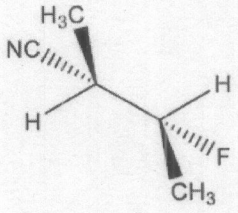
5.

a) Draw the Newman projection looking down the C_2-C_3 bond based off the specific conformer of the given structures below:

I.



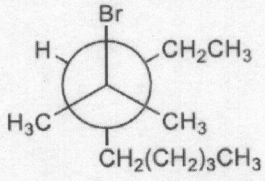
II.



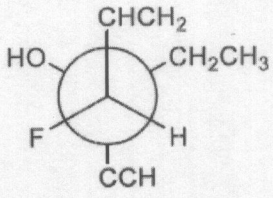
(4 marks)

b) Based off the Newman project below, draw the skeletal structures for each compound:

I.



II.



(6 marks)

c) Draw the most stable and the least stable conformations of *trans*-1,2-dimethylcyclohexane.

(6 marks)

d) Draw a qualitative energy diagram for $CH_3CH_2CH_2CH(CH_3)_2$, relative to the bond between the two CH_2 carbons. The Newman projections are drawn below, using **"iPr"** as an abbreviation for the isopropyl $CH(CH_3)_2$ group.

(9 marks)

The Periodic Table of the Elements

1 **H** Hydrogen 1.00794																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012182											5 **B** Boron 10.811	6 **C** Carbon 12.0107	7 **N** Nitrogen 14.00674	8 **O** Oxygen 15.9994	9 **F** Fluorine 18.9984032	10 **Ne** Neon 20.1797
11 **Na** Sodium 22.989770	12 **Mg** Magnesium 24.3050											13 **Al** Aluminum 26.981538	14 **Si** Silicon 28.0855	15 **P** Phosphorus 30.973761	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.4527	18 **Ar** Argon 39.948
19 **K** Potassium 39.0983	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.955910	22 **Ti** Titanium 47.867	23 **V** Vanadium 50.9415	24 **Cr** Chromium 51.9961	25 **Mn** Manganese 54.938049	26 **Fe** Iron 55.845	27 **Co** Cobalt 58.933200	28 **Ni** Nickel 58.6934	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.39	31 **Ga** Gallium 69.723	32 **Ge** Germanium 72.61	33 **As** Arsenic 74.92160	34 **Se** Selenium 78.96	35 **Br** Bromine 79.904	36 **Kr** Krypton 83.80
37 **Rb** Rubidium 85.4678	38 **Sr** Strontium 87.62	39 **Y** Yttrium 88.90585	40 **Zr** Zirconium 91.224	41 **Nb** Niobium 92.90638	42 **Mo** Molybdenum 95.94	43 **Tc** Technetium (98)	44 **Ru** Ruthenium 101.07	45 **Rh** Rhodium 102.90550	46 **Pd** Palladium 106.42	47 **Ag** Silver 107.8682	48 **Cd** Cadmium 112.411	49 **In** Indium 114.818	50 **Sn** Tin 118.710	51 **Sb** Antimony 121.760	52 **Te** Tellurium 127.60	53 **I** Iodine 126.90447	54 **Xe** Xenon 131.29
55 **Cs** Cesium 132.90545	56 **Ba** Barium 137.327	57 **La** Lanthanum 138.9055	72 **Hf** Hafnium 178.49	73 **Ta** Tantalum 180.9479	74 **W** Tungsten 183.84	75 **Re** Rhenium 186.207	76 **Os** Osmium 190.23	77 **Ir** Iridium 192.217	78 **Pt** Platinum 195.078	79 **Au** Gold 196.96655	80 **Hg** Mercury 200.59	81 **Tl** Thallium 204.3833	82 **Pb** Lead 207.2	83 **Bi** Bismuth 208.98038	84 **Po** Polonium (209)	85 **At** Astatine (210)	86 **Rn** Radon (222)
87 **Fr** Francium (223)	88 **Ra** Radium (226)	89 **Ac** Actinium (227)	104 **Rf** Rutherfordium (261)	105 **Db** Dubnium (262)	106 **Sg** Seaborgium (263)	107 **Bh** Bohrium (262)	108 **Hs** Hassium (265)	109 **Mt** Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				

58 **Ce** Cerium 140.116	59 **Pr** Praseodymium 140.90765	60 **Nd** Neodymium 144.24	61 **Pm** Promethium (145)	62 **Sm** Samarium 150.36	63 **Eu** Europium 151.964	64 **Gd** Gadolinium 157.25	65 **Tb** Terbium 158.92534	66 **Dy** Dysprosium 162.50	67 **Ho** Holmium 164.93032	68 **Er** Erbium 167.26	69 **Tm** Thulium 168.93421	70 **Yb** Ytterbium 173.04	71 **Lu** Lutetium 174.967
90 **Th** Thorium 232.0381	91 **Pa** Protactinium 231.03588	92 **U** Uranium 238.0289	93 **Np** Neptunium (237)	94 **Pu** Plutonium (244)	95 **Am** Americium (243)	96 **Cm** Curium (247)	97 **Bk** Berkelium (247)	98 **Cf** Californium (251)	99 **Es** Einsteinium (252)	100 **Fm** Fermium (257)	101 **Md** Mendelevium (258)	102 **No** Nobelium (259)	103 **Lr** Lawrencium (262)

1995 IUPAC masses and Approved Names from http://www.chem.qmw.ac.uk/iupac/AtWt/
masses for 107-111 from C&EN, March 13, 1995, p. 35
112 from http://www.gsi.de/z112e.html

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

BACHELOR OF FOOD SCIENCE AND TECHNOLOGY

FUNDAMENTALS OF ELECTRICAL ENGINEERING FOR FOOD SCIENCE

AGF 2251

2017-2018 MID-YEAR EXAMINATIONS

DURATION: THREE (3) HOURS **VENUE: OMNIA 2**

INSTRUCTIONS TO THE CANDIDATES:

1. PLEASE READ THE INSTRUCTIONS AND EACH QUESTION CAREFULLY.
2. THIS PAPER HAS **FOUR** QUESTIONS AND EACH CARIES **25 MARKS**
3. ANSWER ALL QUESTIONS.

QUESTION 1 [25 points]

(a) Why should an ideal ammeter have zero resistance? (2.5 points)

(b) If two bulbs are connected in parallel and one bulb blows out, will the other bulb continue glowing? (2.5 points)

(c) What determine the amount of current in each branch of a parallel circuit? (5 points)

(d) Give two reasons why static electricity cannot be harnessed for industrial applications (5 points)

(e) Define the following electrical engineering terms:

(i) Charge (2 points)

(ii) Alternating current (2 points)

(iii) Resistance (2 points)

(iv) Kilowatt hour (2 points)

(v) Voltage (2 points)

QUESTION 2 [25 points]

Four elemental resistors of a boiler used to generate steam for a steam jacketed milk pasteurizer are connected in a circuit as shown in Figure 1.

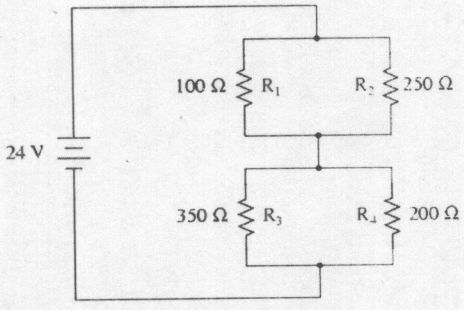


Figure 1. Four elemental boiler system

a) Calculate the voltage across R_1, R_2, R_3, and R_4. (7.5 points).

b) And hence calculate the current flowing through R_1, R_2, R_3, and R_4. (7.5 points).

c) Differentiate between passive and active circuit elements and give two examples of each. (5 points)

d) Using the I-V graph, show how a non-ohmic conductor behave. Give one example of such conductors. (5 points)

QUESTION 3 [25 points]

a) Most food processing factories have electric generator backups installed in their establishments.

(i) Briefly describe the working principle of an electric generator (5 points)

(ii) Why is the installation of these machines economically relevant? (5 points)

a) A transformer has 500 turns of the primary winding and 10 turns of the secondary winding.

(i) Determine the current in the primary and secondary winding, given that the secondary winding is connected to a resistance load 15 Ω? (5 points)

(ii) Give three practical applications of a transformer? (6 points)

(iii) Why is it necessary to know the turns ratio of a transformer? (4 points)

QUESTION 4 [25 points]

a) Electric motors are very important machines that have found widespread application in the food industry.

(i) Describe Five components of a typical electrical motor. (5 points)

(ii) Give one key difference between the synchronous and asynchronous motors (5 points)

(iii) List five factors that may cause burning out of electric motor in the food industry operations (2.5 points)

(iv) Give 5 examples of mechanical drive operations in the food industry that are aided by an electrical motor (2.5 points)

b) Study the design configuration of multiple evaporators in Figure 2 for concentrating pure fruit juice from 10 % total soluble solids (starting material) to 30% total solids (final product). The ground rules for the plant operation are as follow:

- The plant will operate 10 hrs./day, 7 days/week, 350 days per year
- Electricity is available on site the current tariffs for Imuka Energy Ventures (IEV) is ZMW 1.5/KWh

Calculate the annual electrical energy cost that your company needs to pay IEV according to this design (10 points)

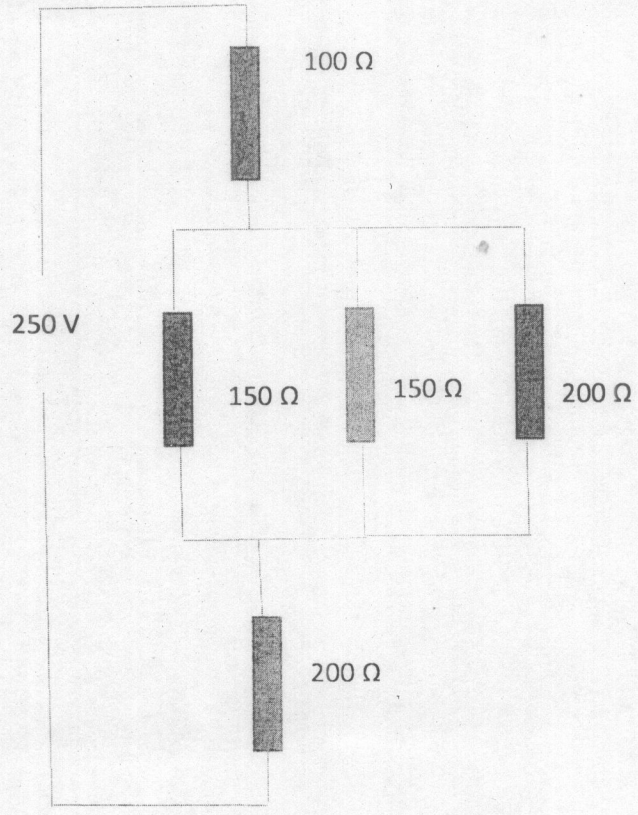


Figure 2. Five multiples evaporator system

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

INTRODUCTION TO INFORMATION TECHNOLOGY AND COMMUNICATION
AGF 2401

2017-2018 FINAL EXAM

Date: 6th JULY 2018
Venue: VLT
Time: 14HOURS – 17HOURS
Duration: 3 Hours

Instructions

1. This exam has one section
2. Answer any five questions. Each question carries 20 Marks.

Section A

Answer any five questions. Each question carries 20 marks

Question 1

A. What is a Computer System? What are the main components of the Computer System? [5]

B. Every day, people around the world rely on different types of computers. List and Explain any five (5) different types of computers? [10]

C. Explain any two different printers? [5]

Question 2

A. Write short notes on 2nd and 3rd generation of computers? [6]

B. Explain about the magnetic storage media and briefly explain about any 2 magnetic storage devices? [8]

C. Differentiate between the following optical storage devices?

i. CD-ROM/DVD-ROM[2]

ii. CD-R/DVD-R[2]

iii. CD-RW/DVD-RW[2]

Question 3

A. Explain how ICT is used in the following sector

i. E-Commerce[2]

ii. Healthcare[2]

iii. Industry[2]

B. Give some guidelines on the E-mail and Internet usage? [6]

C. What is a Computer Security? List and briefly explain the different types of Computer Security?[8]

Question 4

A. List and explain any five malicious code that affects the computers? [10]

B. Today, people rely on computers to create, store and manage critical information. It is important that the computer and the data they store are accessible and available when needed. It is also important that users take measures to protect their computers and data from lost, damage and misused.

Explain different types of security measures that protect your computer and data? [10]

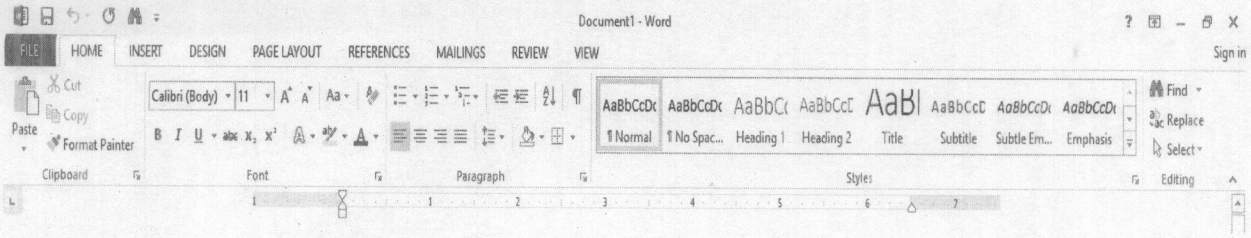
Question 5

A. Software applications are used for many reasons. Give some examples of software applications that used in Home and Education, Business, Graphics and Multimedia and Communication? [10]

B. People around the world rely on computers to do so many things. Explain different categories of Computer Users?[10]

Question 6

A. You are required to do a number of tasks in Microsoft Word and when you open Microsoft the following window opens. Explain which menu you will select to do the following tasks. [6]



i. To Insert Citation

ii. Thesaurus

iii. Orientation

iv. Hyperlink

v. Find and Replace

vi. Comment

B. What are the purposes and benefits of using MS Word? [6]

C. Explain the different items that is under Font? Use the above picture as your reference[8]

Question 7

A. What are the purposes and benefits of using MS PowerPoint? [6]

B. Explain any five layouts used in PowerPoint? [10]

C. Write down any four terminologies used in the presentation software? [4]

THE UNIVERSITY OF ZAMBIA

School of Agricultural Sciences

Department of Food Science and Technology

INTRODUCTION TO INFORMATION TECHNOLOGY AND COMMUNICATION AGF 2401

2018-2019 FINAL EXAM

Date: 12th JULY 2019
Venue: VLT
Time: 14HOURS – 17HOURS
Duration: 3 Hours

Instructions

1. This exam has one section
2. Answer any five questions. Each question carries 20 Marks.

Section A

Answer any five questions. Each question carries 20 marks

Question 1

A. What is an Operating Systems? What are the different roles of an Operating System? [5]

B. Every day, people around the world rely on different types of computers. List and explain any five (5) different types of computers? [10]

C. What is the difference between Graphical User Interface GUI and Command Line Interface CLI [2]

D. List some of the emerging technologies in ICT? [3]

Question 2

A. Explain briefly about the different sensors used as a input devices [6]

B. Explain briefly about the different types of output devices? [8]

C. Explain about the magnetic storage media and briefly explain about any 2 magnetic storage devices? [6]

Question 3

A. What is a Network? Explain briefly the different types of network? [8]

B. Explain briefly about the different devices used in the network? [8]

C. List the different types of communication in network? [4]

Question 4

A. Explain how ICT is used in the following sector

   i. Banking[4]

   ii. Healthcare[4]

   iii. Monitoring and Tracking Systems[4]

B. Explain the different stages in the System Life Cycle? [8]

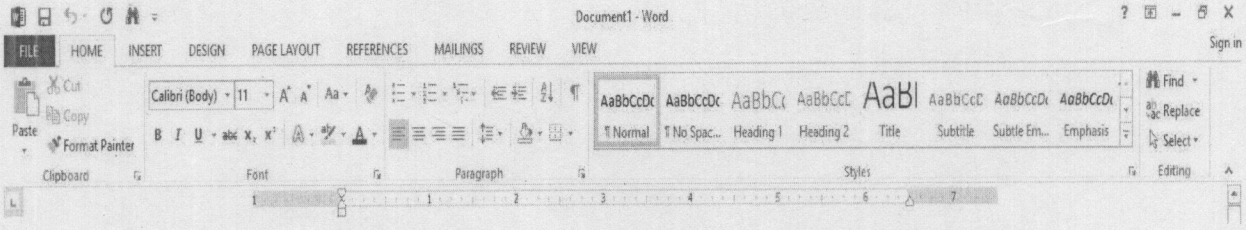
Question 5

A. Explain the different security issues like Hackers, Viruses, Spyware, Phishing and Pharming and also explain how to prevent the data from the above security issues? [15]

B. Give some of the physical safety risks faced by the user? [5]

Question 6

A. You are required to do a number of tasks in Microsoft Word and when you open Microsoft the following window opens. Explain which menu you will select to do the following tasks. [6]



   i. Cross-reference

   ii. Thesaurus

   iii. Text Box

   iv. Watermark

v. Footnote and Endnote

vi. Comment

B. What is the difference between  and  ? [2]

C. What is the difference between Animation and Transition? [2]

D. What is the difference between Wrap Text and Merge & Center? [2]

E. Explain the different items that is under Font? Use the above picture as your reference[8]

Question 7

A. Explain any five layouts used in PowerPoint? [10]

B. Explain any 3 different types of charts? [6]

C. List any 4 functions that you used in the Excel? [4]

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

2017/18 ACADEMIC MID-YEAR EXAMINATIONS

AGF 3021
Chemical Techniques in Food Analysis –Theory Exam

Date: 10Th July, 2018
Time: 09:00 Hours – 12:00 Hours
Venue: Omnia 1

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES

1. THIS PAPER CARRIES 100 MARKS.
2. THERE ARE SIX (6) QUESTIONS IN THIS PAPER. **QUESTION ONE (1) IS COMPULSORY** AND ANSWER ANY OTHER FOUR (4) QUESTIONS
3. ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOKLET.
4. ALLOCATED MARKS FOR EACH QUESTION ARE INDICATED IN THE BRACKETS.

Section A

QUESTION 1 IS COMPULSORY AND ANSWER ANY OTHER TWO (2Ø) QUESTIONS.

QUESTION 1

Residents in D1 constituency have their water supplied by Mwatiko Water and Sewerage Company. One day, a resident from this constituency comes to you with the following complaints:

1. The water for washing give them problem as the wash water does not foam properly
2. Water for drinking have a soapy taste
3. There is formation of scales or white residues in the equipment i.e. geysers and pipes and these most of the times causes blockages of the pipes.

As a trained Environmentalist/Laboratory analyst, you are asked to evaluate the problem and offer possible solutions.

a) After analyzing the situation, what could be the source of the problem? Explain. **(5 Marks)**

b) The following results were obtained after analyzing the water sample (W1) in the laboratory:

Sample	Volume (ml) of EDTA used for Calcium Hardness determination	Volume (ml) of EDTA used for Total Hardness determination
W1	6.5	10.2

EDTA = Ethelenediaminetetraacetic acid, a titrant.

i. What is the amount of calcium in the sample (W1) in mg/l? **(2 Marks)**

ii. Calculate the amount of magnesium in W1 sample. **(8 Marks)**

c) What advice can you give to the water and sewerage company in order for them to solve the problem raised by the resident of D1 constituency? **(5 Marks)**

QUESTION 2

a) In analytical chemistry, students often encounter qualitative, semi-qualitative and quantitative analyses which are destructive or non-destructive in nature. Define the five (5) key terms from the previous statement, giving examples for each where necessary. **(5 Marks)**

b) A series of eight neutral sugars determinations using an HPLC were conducted. Results for galactose (gal), which is one of the neutral sugars determined, were as follows: 0.855, 0.836, 0.848, 0.899, 0.859, 0.841, 0.861, and 0.852 mg gal/g sample. According to the instrument manufacturer, the precision of the galactose determination using this instrument should not

exceed 1% RSD. Does the HPLC in this case meet the precision expectations of the instrument manufacturer? **(12 Marks)**

c) For the data obtained in **part b),** calculate the Q-value and give conclusions on the results. Useful information is provided in Table 1. **(3 Marks)**

Table 1: Q-values for the 90% Confidence Level

Number of measurements	Q (at 90% Confidence Level
3	0.94
4	0.76
5	0.64
6	0.56
7	0.51
8	0.47
9	0.44
10	0.41

QUESTION 3

An animal feed manufacturing company brings to you a 50 Kg bag of maize grains for the determination of mineral content using atomic absorption spectroscopy. As a laboratory analyst, describe in detail how you can approach this task. **(20 Marks)**

QUESTION 4

a) The department of Food Science and Nutrition has bought two (2) sets of equipment, that is, an analytical weighing balance and a pH meter. During a laboratory session, the Chief Technician in the Food Chemistry Laboratory realizes that these sets of equipment are not properly calibrated. As a student in this department, briefly discuss how you can calibrate these equipment.
(4 Marks)

b) List the three (3) main steps involved in a gravimetric analysis, and define a gravimetric factor (GF). **(4 Marks)**

c) An ore is analyzed for the manganese (Mn) content by converting the manganese to Mn_3O_4 and weighing it. If a 1.52-g sample yields Mn_3O_4 weighing 0.126 g, what would be:

i. The percent Mn_2O_3 in the sample?

ii. The percent Mn in the sample? **(6 Marks)**

d) How many grams of copper (II) sulfate hexahydrate are required to prepare a solution that has the equivalent of 0.339 g of copper dissolved? What is the percentage composition of sulphur in the solution? **(6 Marks)**

Section B

QUESTION 5

a) Define the following terms.

I. Equivalent point.

II. End point. Describe how the end points of Redox Titrations may be detected. **(4 marks)**

b) 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. Calculate the Volume of HCl required to completely neutralizing the NaOH. **(2 marks)**

II. Copy and complete the table by calculating the number of moles of HCl present at the given points. **(6 marks)**

c) An impure sample of barium hydroxide - $Ba(OH)_2$ 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. **(8 marks)**

QUESTION 6

a) A peak with a retention time of 407 s has a width at the base of 13 s. A neighboring peak is eluted at 424 s with a width of 16 s. Find the resolution for these two components.

(4 marks)

b) A mixture of benzene, toluene, and methane was injected into a gas chromatograph. Methane gave a sharp spike in 42 s, where as benzene required 251 s and toluene was eluted in 333 s. Find the adjusted retention time and capacity factor for each solute and the relative retention.

(6 marks)

c) The relative retention for two compounds in gas chromatography is 1.068 on a column with a plate height of 0.520 mm. The capacity factor for compound 1 is 5.16.

I. Find the separation factor for the two compounds and the length of column that will separate the compounds with a resolution of 1.00?

II. The retention time for air (t_m) is 2.00 min. If the number of plates is the same for both compounds, find t_r and $w_{1/2}$ for each peak. If the ratio of stationary phase to mobile phase is 0.30, find the partition coefficient for compound 1.

(10 marks)

END OF EXAMINATION

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

2018 ACADEMIC YEAR
MID-YEAR EXAMINATION

COURSE: AGF 3031
Food Chemistry (Theory)

Date: 7th July 2018 **Time: 09.00 – 12.00 Hours**

Duration: THREE (3) HOURS **Venue: Omnia 1**

INSTRUCTIONS TO CANDIDATES:

1. There are two (2) sections in this examination paper, Section A and Section B.
2. Each section has three questions. **Answer all questions in both sections.**
3. The marks allocated are given at the end of each question.
4. Answers to the two sections should be given in separate booklets.

SECTION A

QUESTION 1

(a) What do you understand by the following terms:

i. Hysteresis in water **(2 marks)**

ii. LD_{50} **(2 marks)**

(b) Give short answers to the following questions

(i) How is the ADI for a recently discovered food additive determined **(2 marks)**

(ii) Write the structure of the following fatty acids: (a) 18:2ω6 (b) 20:4 (n-6) **(2 marks)**

(iii) A tin of baked beans had the following nutritional label per 50g serving:

- Water content 4.0g
- Protein content 25.0g
- Carbohydrate content 15.0g
- Oil content 5.0g
- Vitamin content 0.05g
- Mineral content 0.95g

Calculate the vitamin content (on dry basis) in μg vitamins/Kg beans **(2 marks)**

QUESTION 2

You have recently developed a blended juice composed of an aqueous based fruit juice and small amount of lipid based liquid. The blended juice is manufactured by homogenizing the two liquids so that the lipid-based liquid is dispersed in the juice blend as small spherical lipid globules distributed uniformly throughout the blended juice. Visually, it is impossible to see the blended juice as being composed of two phases after homogenization. It was decided to also add the following food additives to the juice blend: tocopherol, quinoline yellow, sorbic acid, potassium bisulfide, butylated hydroxyanisole (BHA), lecithin, carrageenan, saccharin and carotenoid.

Give plausible reasons for the addition of each of these food additives. For food additives with multiple reasons, state them clearly as separate reasons **(20 marks)**

QUESTION 3

Groundnuts flour is packaged in a moisture and air permeable packaging container. The groundnuts has the following initial properties: moisture content = 4%, a_w = 0.3, fat content = 55%. A laboratory analysis shows that the groundnut flour is initially rancid-free. The container and its content were initially maintained at 4°C for 14 days at 25% relative humidity. Thereafter, the container and its content were transferred to another room with temperature averaging 40°C. The container and its contents were kept in this new room for a further 14 days at 90% relative humidity. With the aid of a hypothetical graph(s), state with plausible reasons the changes you would expect in the composition of groundnut flour at the end of the 28 days storage in the following properties:

(a) Moisture content **(3 marks)**

(b) Water activity **(3 marks)**

(c) Lipid composition **(10 marks)**

(d) Sensorial properties **(4 marks)**

SECTION B

QUESTION 1

In relief food distribution to combat malnutrition and hunger usually they encourage the distribution of high energy (cereals and a bit of fat) and high protein food (soya beans) and other foods like micronutrients. In the event that they run out of high protein food, explain why you would encourage them to still feed the affected with high energy foods until protein foods arrive.

(20 Marks)

QUESTION 2

1. What are pectin substances? What makes then different even though they are grouped together? Where are they mainly found? **(5 Marks)**
2. What makes starch different from glycogen? **(2 Marks)**
3. Name and describe 3 methods of eliminating enzymatic browning **(3 Marks)**
4. What is lignin? **(1 Mark)**
5. Give the names of enzymes that are associated with liquefying of starch and saccharifying of starch. **(2 Marks)**
6. Give 3 reasons, which makes the studying of enzymes important in food science and nutrition. **(3 Marks)**
7. What is lactose intolerance? When does it occur and why does it cause bloating or retention of fluids. **(4 Marks)**

QUESTION 3

1. State the situations when proteins have lost their quality **(5 Marks)**
2. Proteins effectiveness is affected by some conditions under which they are subjected to. State and describe these conditions in your own understanding. **(5 Marks)**

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

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

2019/2020 ACADEMIC YEAR
FINAL DEFERRED EXAMINATION

COURSE: AGF 3031
Food Chemistry (Theory)

Date: Wednesday, 13th January 2021 **Time: 09.00 – 10.30 Hours**

Duration: One and half hours **Venue: Sports hall**

INSTRUCTIONS TO CANDIDATES:

1. There are two (2) sections in this examination paper, Section A and Section B. The two sections carry equal marks
2. There are two questions in each section. **Answer all questions in both sections.**
3. The marks allocated are given at the end of each question.
4. Answers to the two sections should be given in separate booklets.

SECTION A

QUESTION 1 (Brief Answers)

(a) What do you understand by the following terms:

i. rac-StOM in fatty acids **(2 marks)**

ii. LD_{50} **(2 marks)**

(b) Mention one major fatty acid in each of the following (i) coconut (saturated) (ii) sunflower oil (unsaturated) and (iii) soyabean oil (unsaturated) **(2 marks)**

(c) Write the structure of the following fatty acid: 20:4 (n-6) **(2 marks)**

(d) A food rich in lipids has been found to go bad when produced without any food additives. But when two classes of food additives are used in the production of the same food, the food becomes much more shelf stable. Suggest any two classes of food additives, give an example of a food additive in each class and explain very briefly why you suggested the two classes of food additives. **(2 marks)**

(e) In nature, lipids are generally found in the *cis*-form than *trans*-form. What is the technological and nutritional effect on heat processing of lipids rich in *cis*-fatty acids? **(2 marks)**

(f) What do you understand by the following terms and what is their importance in food industry:

i. Hydrocolloid **(2 marks)**

ii. Iodine value **(2 marks)**

(g) Packaged dried moringa leaves have the following nutritional label per 50g:

Moisture content: 4.0g; Protein content: 25.0g; Carbohydrate content: 15.0g; Oil content: 5.0g; Vitamin content: 0.05g; and Mineral content: 0.95g.

Calculate the:

(i) vitamin content in percentage on wet basis **(1 mark)**

(ii) vitamin content on wet basis in g/kg dried leaves **(2 marks)**

(iii)vitamin content on dry basis in g/kg dried leaves **(3 marks)**

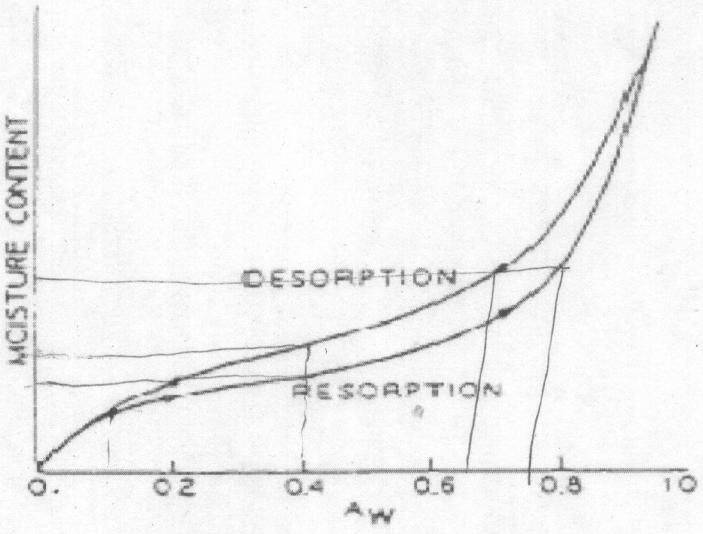
(iv)vitamin content to mg/kg, db dried leaves **(3 marks)**

QUESTION 2

Examine the following graph. The graph exemplifies a number concepts concerning water. Identify four (4) of the **most important concepts** related to water represented in this graph. For each of the four concepts you identify: define each concept in full and state each concept's implication on food stability with practical examples related to food or food processing **(25 marks)**

-3

10



SECTION B

QUESTION 1

(a) Name the proteins from wheat, maize and sorghum **(3 marks)**

(b) In improving the quality of proteins, name and describe 4 ways in which this can be achieved **(8marks)**

(c) Briefly describe how proteins are classified **(4 marks)**

(d) Describe egg proteins in detail and in terms of their qualities **(2 marks = 10 marks)**

(i) Heat stability

(ii) Heat sensitivity

(iii) Anti-bacterial

(iv) Anti-microbial

(v) Anti-micronutrient (one)

QUESTION 2

(a) Define the following **(5marks each = 15 marks)**

(i) Protein denaturation

(ii) Protein degradation

(iii) Protein deterioration

(b) Name and describe 3 factors responsible for protein alteration and their implication on the quality of the altered proteins **(3 marks)**

(c) Soya beans are rich in oil and proteins. What else does it contain **(3 marks)**

(d) Name two simple proteins and 2 complex proteins **(4 marks)**

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

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

2018 ACADEMIC YEAR MID-YEAR EXAMINATION

COURSE: AGF 3031
Food Chemistry (Practical)

Date: 7th July 2018 **Time: 14.00 – 17.00 Hours**

Duration: THREE (3) HOURS **Venue: Other Rooms**

INSTRUCTIONS TO CANDIDATES:

1. There are two (2) sections in this examination paper, Section A and Section B.
2. Each section has three questions. **Answer all questions in both sections**.
3. The marks allocated are given at the end of each question.
4. Answers to the two sections should be given in separate booklets.

SECTION A

QUESTION 1

You are given a protein food for under five children and you have been told that the food is of high biological value. Using the Kjeldhal method describe how you would analyze this food following the three original steps and include the modifications that have been made to this method. Additionally, explain why these chemicals are used: selenium/copper, potassium and boric acid, and the conversion factors and their significance in protein analysis. **(20 Marks)**

QUESTION 2

You are given a sample to determine the ash content. Describe how you would do it. Further, you can also determine some other food constituencies from the ash. Name one food constituency that can be determined from the ash and explain how you would do it. **(20 Marks)**

QUESTION 3

1. What is dietary fibre? Name two foods which are good sources of fibre. **(3 Marks)**
2. Name two foods, which are not good sources of proteins. **(2 Marks)**
3. Name two monosaccharides, two disaccharides and one polysaccharide **(3 Marks)**
4. Why is there no browning in intact fruits? **(2 Marks)**

SECTION B

QUESTION 1

What do you understand by the following terms and what is the importance of determining these in a food sample:

(a) Solid fat index **(2 marks)**
(b) Water activity **(2 marks)**
(c) Fatty acids profile **(2 marks)**
(d) Free fatty acidity **(2 marks)**
(e) Dry matter **(2 marks)**

QUESTION 2

(a) Assume you were in-charge of a laboratory determining moisture content of food and food products. A Non-governmental Organization has brought to your laboratory a high energy protein supplement (HEPS) to determine the moisture content. In order to determine the moisture content, you weighed a dry dish with its cover (27.5234g). To the weighed dish, you placed 2.0078g of HEPS in the dry dish. After loosening the cover, you placed the dish in an oven for 1 hour at 120°C. Thereafter, you removed the dish from the oven, tightened the cover quickly and cooled it in a desiccator for 1 hour. You weighed the dish with the cover again giving a weight of 29.3505g.

(i) Calculate the moisture content (in %) on wet basis (wb) **(3 marks)**
(ii) Calculate the moisture content (in %) on dry basis (db) **(2 marks)**

(b) Later, the same NGO asked you to determine the oil content of the same HEPS in Q2 (a) above. In order to determine the oil content, you carefully ground and homogenized the HEPS. You gently mixed the HEPS prior to weighing the test portion. You weighed 5.0056g of HEPS and transferred the HEPS into the extraction thimble. You plugged lightly the mouth of the thimble with cotton wool. The oil was extracted with 250ml of petroleum ether for about 7 hours in a previously dried and weighed extraction flask, 27.1235g. After 7 hours of soxhlet extraction, you evaporated the solvent with a rotor evaporator. You then dried the extracted content at 60°C for 30 minutes and placed it in the dessicator to cool. After cooling for 1 hour, you weighed the extraction flask and its content, 27.6241g. The oil content was also determined on the same HEPS using a standard method. It was found that the fat content was 18.3% on dry basis.

(i) Calculate the oil content (%) in the HEPS **(3 marks)**
(ii) Calculate the oil content (in %) on dry basis (db) **(3 marks)**
(iii) Express the oil content on wet basis as $gH_2O/100g$ HEPS and kgH_2O/kg HEPS **(3 marks)**
(iv) What is the recovery rate of the soxhlet method, and comment on the recovery rate of the soxhlet method? **(2 marks)**
(v) What difference would you expect on the oil content if you used a methanol:chloroform (1:1) organic solvent mixture to extract the oil in the soxhlet method? Explain your answer. **(2 marks)**
(vi) What other method would you use to determine the oil content in the HEPS? **(2 marks)**

QUESTION 4

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

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

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND NUTRITION

2019/20 ACADEMIC YEAR DEFERRED EXAMINATIONS

AGF 3042

INSTRUMENTAL METHODS IN FOOD ANALYSIS - THEORY EXAM

Date: 11th JANUARY 2021 - MONDAY

Time: 14 00 hrs – 15 30 hrs

Duration: ONE HOUR AND THIRTY MINUTES (1½ HRS)

Venue: SPORTS HALL

INSTRUCTIONS TO THE CANDIDATES:

1. There are **two (2)** sections in this examination paper: **Section 1** and **Section 2**
2. Answer **ALL** questions to **Section 1** and **Section 2** in **SEPARATE** answer sheets
3. **All** questions in **both sections** carry equal marks of thirty **(30)** marks each with a total of sixty (**60**) marks for the whole paper
4. Marks allocated for each question are shown in parentheses

SECTION 1: ANSWER ALL QUESTIONS FROM THIS SECTION IN SEPARATE BOOKLET

QUESTION 1 [30 MARKS]

a) List and define the three (3) types of thermal analysis techniques commonly used in analytical chemistry. **(3 Marks)**

i. Differentiate the two (2) types of thermal analysis which were discussed in class. Use illustrations curves and examples of thermal properties involved. **(8 Marks)**

ii. What are the principle applications of thermal analysis techniques? **(1.5 Mark)**

b) Quality assurance (QA) is part of the responsibility of the quality assurance unit in any organisation.

i. Define QA. **(1.5 Mark)**

ii. Briefly discuss, giving examples, any three (3) typical quality control activities involved in QA. **(6 Marks)**

c) The polyacrylamide (PA) gel is formed by the radical polymerisation of acrylamide monomers. What is name given to the crosslinking agent that brings about the 3-Dimensional structure of the PA gel? **(1 Mark)**

There are several PAGE methods that can be applied mostly for the separation of proteins based on distinct molecular properties. Briefly discuss the following methods of protein separation: (Use illustrations where necessary).

i. SDS-PAGE **(4.5 Marks)**

ii. 2-Dimensional PAGE **(4.5 Marks)**

P.T.O

SECTION 2: ANSWER ALL QUESTIONS FROM THIS SECTION IN SEPARATE ANSWER SHEETS

Part A: Answer ALL questions in the given answer sheets [15 Marks]

1. One of the following techniques has a magnet as part of its structure. Circle the correct answer **(1.5 marks)**

   a. HPLC

   b. GC

   c. MS

   d. UV - Vis

2. All the following are core principles of chromatography except _____ **(1.5 marks)**

   a. Gel permeation

   b. Ion exchange

   c. Absorption

   d. Partition

3. One of the following is a non-destructive technique. Which one is it?

   a. NMR

   b. NIR

   c. UV-Vis

   d. AES

4. ECD is a detector that can do **ALL** the following except _____ **(1.5 marks)**

   a. Sulphur containing compounds

   b. Selenium containing compounds

   c. Pesticide residues

   d. Nitrogen containing compounds

5. A mobile phase in chromatography can be any of the following except _____ **(1.5 marks)**

   a. Supercritical fluid

   b. Liquid

   c. Porous solid

   d. Gas

6. The following are examples of alkaline earth metals except _____ **(1.5 marks)**

   a. Calcium

   b. Sodium

   c. Strontium

   d. Magnesium

7. Mirrors are a feature of all the following equipment except _____ **(1.5 marks)**

   a. Michelson Interferometer

   b. Newer model UV – Vis Spectrometer

   c. Diffraction grating device

   d. Older model UV – Vis Spectrometer

8. One of the following is termed a spectrophotometric method but does not necessarily use any spectrometric radiation in its operation. Which one is it? **(1.5 marks)**

   a. NMR

   b. AAS

   c. UV – Vis

   d. MS

9. All the following are main components of an GC except _____ **(1.5 marks)**

   a. Oven

   b. Detector

   c. Injector

   d. Pump

10. Which of the following has the longest wavelength? **(1.5 marks)**

    a. UV

    b. ?-rays

    c. RF

    d. Vis

P.T.O

PART 2: ANSWER ALL THE QUESTIONS IN THIS SECTION. [15 Marks]

1. Answer the following questions related to the information shown in **Table 1**.

Table 1: Absorbance readings of a standard solution and a sample (X) measured at 610 nm

Sample / Standard	Tube / Flask #	Standard solutions Concentration mg/ml	Absorbance reading
Standard solutions	1	0.0	-0.004
	2	0.4	0.375
	3	0.8	0.738
	4	0.12	1.078
	5	0.16	1.437
	6	0.20	1.914
Absorbance reading of the given sample (X)	1	-	
	2	-	

a. In your AGF 3042 class, two (2) ways of calculating the concentration of the sample X given the results in Table 1. Clearly explain these two (2) ways (do not calculate the concentration just - give the explanation of how to do so). **(5 marks)**

2. Answer the following answers by giving a technique (full names) that is best suited for it and in some instances give a reason why you have given that choice:

   a. Name **two (2)** possible techniques that you would use to quantify a metallic atom that emits radiation after excitation by some light of a given wavelength. **(2 marks)**

   b. A student wants to study the profile of fatty acids extracted from lipids of edible insects. What method would you recommend to him and why? **(3 marks)**

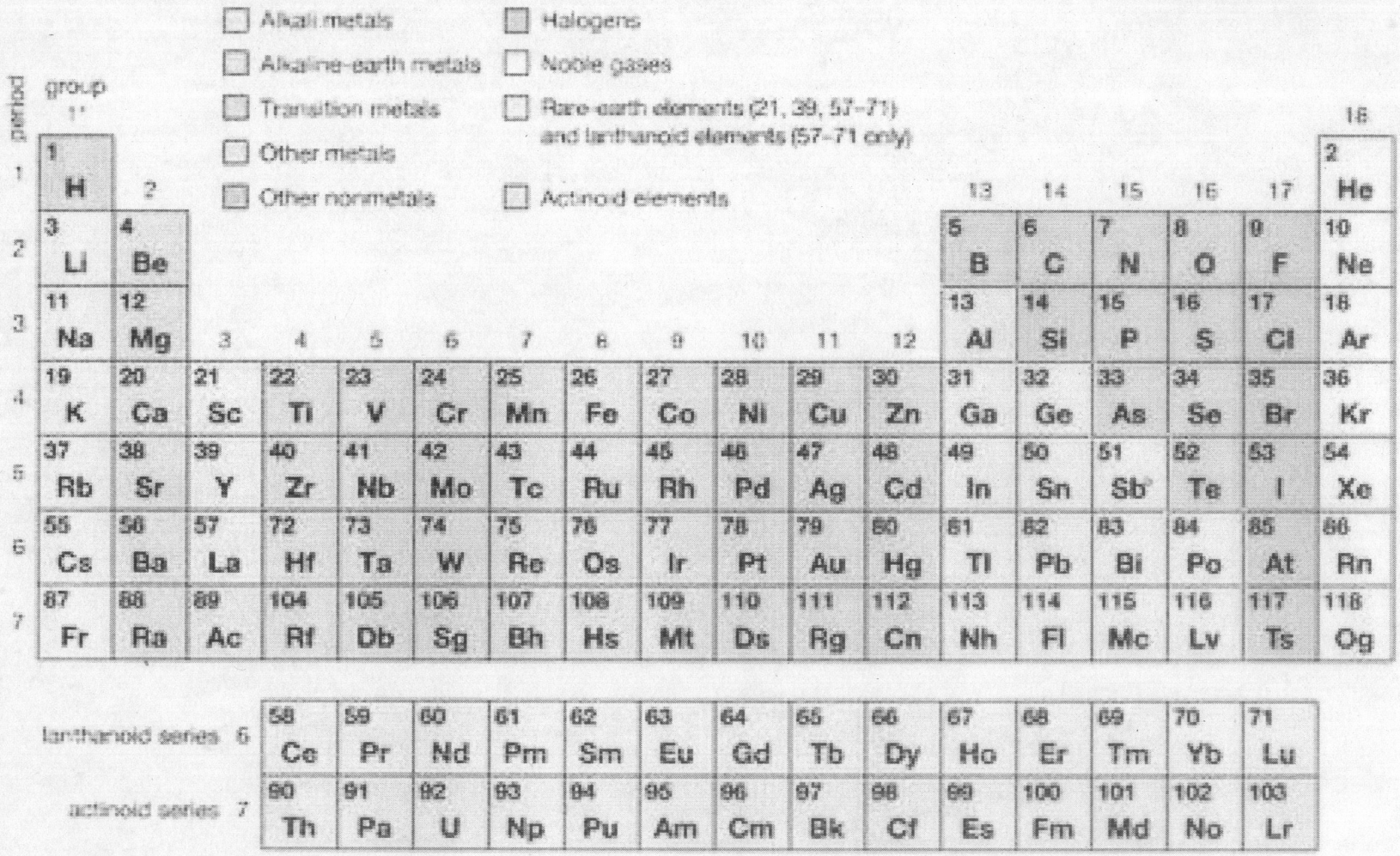
   c. The characteristics of a compound are communicated as follows: It is a green compound that absorbs maximum light at 510 nm. What analytical technique would you use to quantify it? Why? **(3 marks)**

   d. You are given the following compounds: $CDCl_3$, D_2O and TMS. What analytical techniques are used with these solutions? **(2 marks)**

END OF EXAMINATION

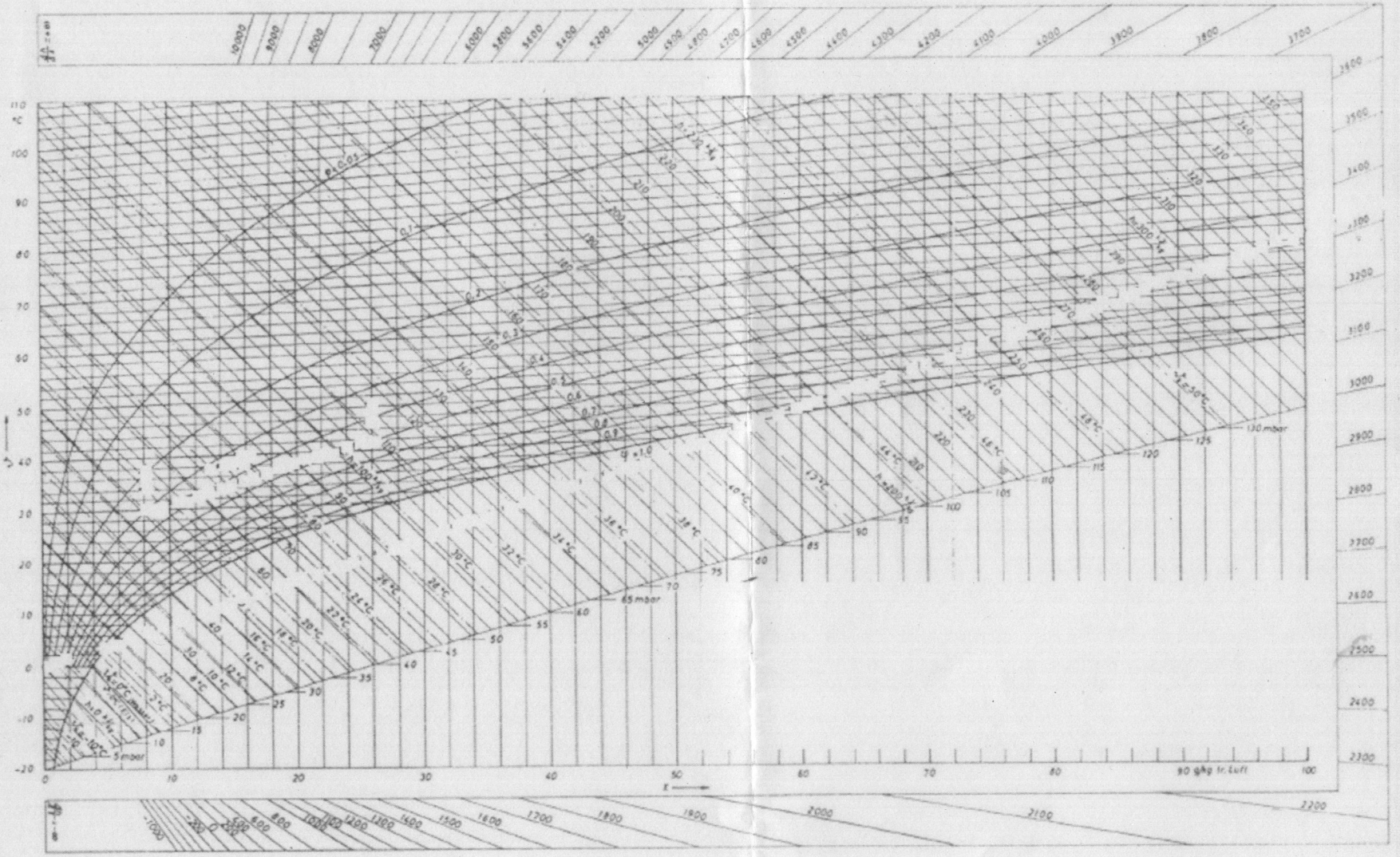
Periodic table of the elements

view as list



*Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC).

h-x-Diagramm für feuchte Luft bei Temperaturen
von – 20 bis 100 °C und P = 1 bar



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

BACHELOR OF FOOD SCIENCE AND TECHNOLOGY

TECHNICAL THERMODYNAMICS
AGF 3201

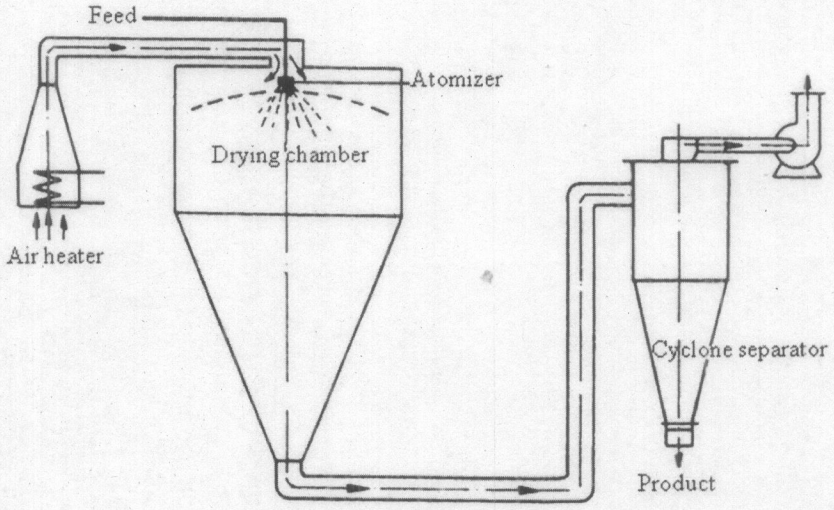
2017/18 MID-YEAR EXAMINATIONS

Date: 4Th July, 2018
Time: 14:00 Hours – 17:00 Hours
Venue: Omnia 2

INSTRUCTIONS TO THE CANDIDATES:

1. PLEASE READ THE INSTRUCTIONS AND EACH QUESTION CAREFULLY.
2. THIS PAPER CARRIES 100 MARKS AND HAS A TOTAL OF FIVE (5) QUESTIONS.
3. EACH QUESTION CARRIES 25 MARKS.
4. ANSWER ANY 4 QUESTIONS ONLY.
5. ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOKLET PROVIDED.

1. The figure shown below is a spray dryer used for the production of powdered milk.



a) What are the two (2) important process-controlling factors that enter into the unit operation of drying?

(2 Marks)

b) Explain the principles of operation of the spray dryer.

(5 Marks)

c) The air used in the spray dryer for the production of powdered milk has an absolute humidity of 6g H_2O/Kg dry air and dry bulb temperature of 24°C at aspiration. The air temperature at the inlet is 100°C. The air at the outlet of the dryer has a dry bulb temperature of 36°C.

i. Sketch the drying process on the Mollier diagram.

(1 Mark)

ii. Determine the characteristics of the air at aspiration, the inlet and outlet of the dryer.

(8 Marks)

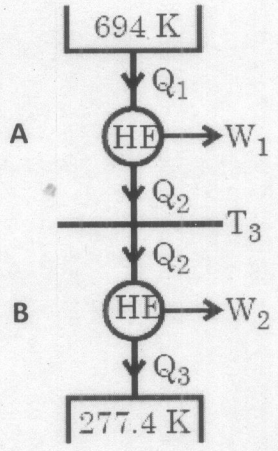
iii. If the flow rate of air entering the spray dryer is 2500 Kg/hour, calculate the amount of energy used to heat the air for the period of 30 minutes of the drying process.

(4 Marks)

2. With the aid of a diagram, explain in detail the stages involved in a drying process.

(20 Marks)

3. Two reversible heat engines A and B are arranged in series, A rejecting heat directly to B. Engine A receives 200 kJ at a temperature of 421°C from a hot source, while engine B is in communication with a cold sink at a temperature of 4.4°C. If the work output of A is twice that of B.



a) The intermediate temperature between A and B

(5 Marks)

b) The efficiency of each engine.

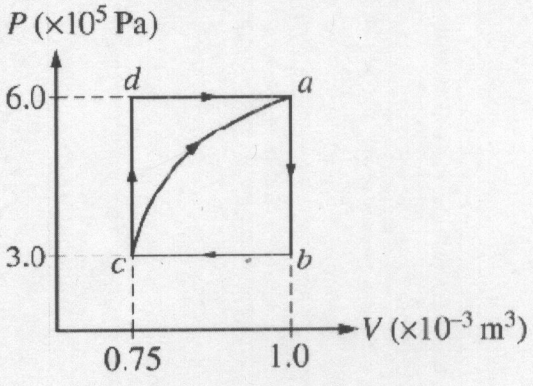
(5 Marks)

c) The heat rejected to the cold sink.

(10 Marks)

4. A cylinder with a movable piston contains 0.1 mole of a monatomic ideal gas. The gas, initially at state a, can be taken through either of two cycles, abca or abcda, as shown on the PV diagram above. The following information is known about this system.

$Q_{c\to a}$ = 685 J along the curved path
$W_{c\to a}$ = −120 J along the curved path
$U_a - U_b$ = 450 J
$W_{a\to b\to c}$ = 75 J



a) Determine the change in internal energy, Ua – Uc, between states a and c.

(2 Marks)

b)

I. Determine if the heat is added to or removed from the gas when the gas is taken along the path abc ?

(4 Marks)

II. Sketch and clearly indicate which path heat added to the gas and removed from the gas and calculate the amount added or removed.

(6 Marks)

c) How much work is done on the gas in the process cda?

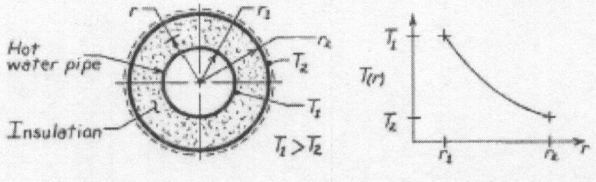
(8 Marks)

5.

a) The convection heat transfer coefficient between a surface at 40°C and ambient air at 20°C is 20 W/m2K. Calculate the heat flux leaving the surface by convection.

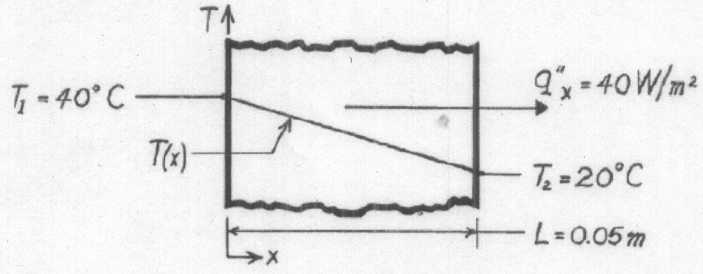
(4 marks)

b) A hot water pipe with outside radius r_1 has a temperature T_1. A thick insulation applied to reduce the heat loss has an outer radius r_2 and temperature T_2. On T–r coordinates, sketch the temperature distribution in the insulation for one-dimensional, steady-state heat transfer with constant properties. Give a brief explanation, justifying the shape of the curve shown.



(6 marks)

c) A rectangular slab of wood that is 50 mm thick has a known heat flux of 40 W/m2. The surface temperatures on both sides of the wood slab are 40 oC and 20 oC, respectively. Calculate the thermal conductivity of the wood and the thickness of an aluminum slab that would be required to achieve the same heat flux for the same temperatures.



(10 marks)

END OF EXAMINATION.

WISH YOU WELL

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

BSC FOOD SCIENCE &TECHNOLOGY

NUTRITION
AGF 4065
2017/ 2018 MID-YEAR EXAMINATIONS

DATE: 13TH JULY, 2018 **TIME: 09 - 12:00H**
DURATION: THREE (3) HOURS **VENUE: VLT**

INSTRUCTIONS TO THE CANDIDATES:

1. ANSWER ALL QUESTIONS

2. ALL QUESTIONS CARRY EQUAL MARKS

Question 1

There are different ways of classifying undernutrition in adults and children

a) What screening tool is shown in Figure 1 below and who does it target? **(1 mark)**

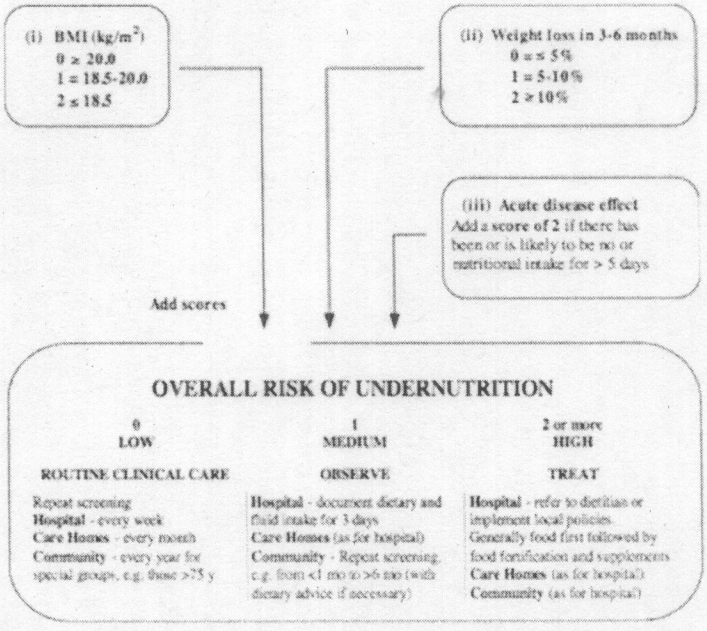


Figure 1

Can be adapted for special circumstances (e.g. when weight and height cannot be measured or when there are fluid disturbances) using specified alternative measurements including subjective criteria. It also identifies obesity (BMI > 30 kg/m^2).

b) Mr. Mweemba of Kabundi Township is a heart disease patient who reports that he lost 2% of his initial weight in the last month and has a BMI of 22 kg/m^2. He further reports that his appetite has been very poor over the last week, being able to eat very little or nothing at each meal.

i. Using the screening tool above, is Mr. Mweemba at risk of undernutrition? Indicate the score and how you got to this answer **(5 marks)**

ii. Describe in detail the exogenous (chylomicron) metabolism of lipids **(9 marks)**

iii. Why are elevated levels of chylomicrons a risk factor for Mr. Mweemba's condition? **(2 marks)**

iv. Name the apolipoprotein that is specific to chylomicrons **(1 mark)**

v. Provide two (2) reasons why omega 3 fatty acids are recommended for heart disease **(2 marks)**

All the best!

Question 2

a) Describe in brief two (2) primary roles of the gastrointestinal tract (GIT) **(4 marks)**

b) Describe the sites of digestion and absorption of fats **(10 marks)**

c) For each of the following, list three (3) important physiologic body functions

   i. Fat

   ii. Protein

(6 marks)

Question 3

Consider Figure 2 below.

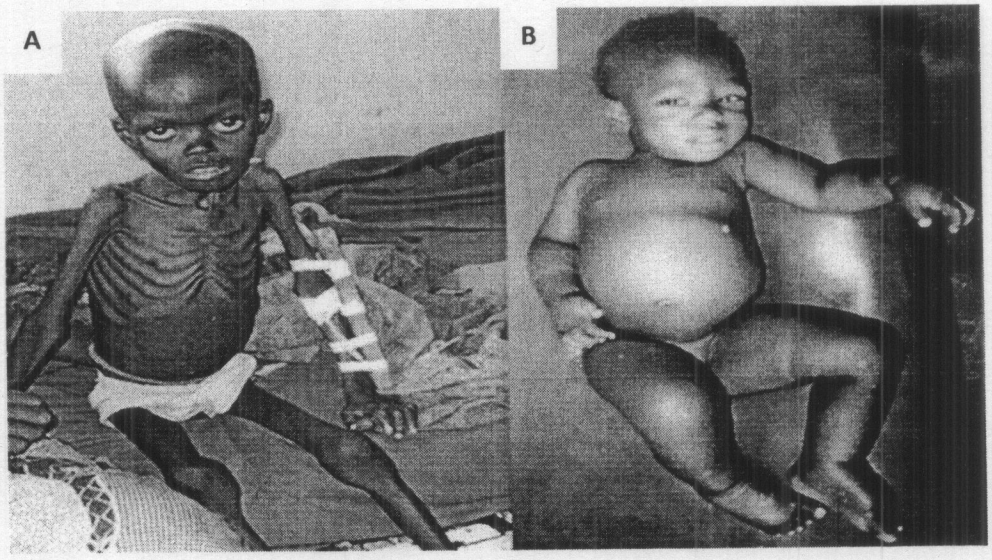


Figure 2

a) Identify the two (2) types of protein energy malnutrition (PEM) shown in Figure 2 and describe five (5) clinical signs/ features that are specific to each type of PEM **(12 marks)**

b) Name the two (2) types of formulae that are prescribed in the malnutrition ward for the children shown in Figure 2 **(2 marks)**

c) How do the formulae you have identified in b) above prevent refeeding syndrome? Be sure to define refeeding syndrome in your answer and explain when the two (2) formulae are administered to the children **(6 marks)**

All the best!

Question 4

a) Explain the major differences between fat-soluble vitamins and water-soluble vitamins. Give two (2) examples of the vitamins from each group. **(12 marks)**

b) List at least three (3) physiologic functions of minerals in the human body **(6 marks)**

c) Write short notes on mineral bioavailability **(2 marks)**

Question 5

a) Define the following:

i. Estimated average requirements (EAR) **(1 mark)**

ii. Recommended dietary allowances (RDA) **(2 marks)**

iii. Adequate intake (AI) **(1 mark)**

iv. Monitoring and evaluation **(4 marks)**

b) Leon is an adult man who is moderately active. On Monday, Leon had the following for lunch:

- 150 g White maize meal nsima
- 80 g fresh boiled cabbage
- 95 g smoked bream

i. Determine Leon's energy and protein intake at lunch **(8 marks)**

ii. If Leon ate a total amount of 2850 kcal and 42 g of protein on Monday, did he meet his RDAs for energy and protein? **(4 marks)**

All the best!

Appendix 1 – Zambian Food Composition Tables

Food and Description	Composition per 100 g edible portion					
	Moisture g	Food energy (ME) cal	Fat g	Protein g	Calcium mg	Zinc mg
Roller meal	12	363	3.5	7.5	12	-
Breakfast meal	12	354	0.5	7	9	-
Mealie rice	11.4	366	1.5	8.9	12	-
Cabbage fresh	91	26	0.1	1.7	47	-
Cabbage (fresh) boiled	91.08	30	0.15	2.75	0.14	0.02
Bream smoked	15	382	12.7	67	-	-
Bream, fresh tilapia	80	91	2.6	17	50	-

Appendix 2 – WHO / FAO Recommended Daily Dietary Allowances

Age	Body weight (Kg)	Energy[a] (Kcal)	(MJ)	Protein (g)	Vitamin[c] A (ug retinol)	Vitamin D (ug retinol)	Thiamin[c]	Riboflavin[c]	Niacin (mg)	Folic Acid[e] (mg)	Vitamin B[e]	Ascorbic Acid[e]	Calcium[g]	Iron[e] (mg)
Children														
< 1	7.3	820	3.4	14	300	10.0	0.3	0.5	5.4	60	0.3	20	0.5-0.6	5-10 [h]
1-3	13.4	1360	5.7	16	250	10.0	0.5	0.8	9.0	100	0.9	20	0.4-0.5	5-10
4-6	20.2	1830	7.6	20	300	10.0	0.7	1.1	12.1	100	1.5	20	0.4-0.5	5-10
7-9	28.1	2190	9.2	25	400	2.5	0.9	1.3	14.5	100	1.5	20	0.4-0.5	5.10
Male Adolescents														
10-12	36.9	2600	10.9	30	575	2.5	1.0	1.6	17.2	100	2.0	20	0.6-0.7	5-10
13-15	51.3	2900	12.1	37	725	2.5	1.2	1.7	19.1	200	2.0	30	0.6-0.7	9-18
16-19	62.9	3070	12.8	38	750	2.5	1.2	1.8	20.3	200	2.0	30	0.5-0.6	5-9
Female Adolescents														
10-12	38.0	2350	9.8	29	575	2.5	0.9	1.4	15.5	100	2.0	20	0.6-0.7	5-10
13-15	49.9	2490	10.4	31	725	2.5	1.0	1.5	16.4	200	2.0	30	0.6-0.7	12.24
16-19	54.4	2310	9.7	30	750	2.5	0.9	1.4	20.3	200	2.0	30	0.5-0.6	14.28
Adult Man (Moderately active)														
	65.0	3000	12.6	37	750	2.5	1.2	1.8	19.8	200	2.0	30	0.4-0.5	5-9
Adult Woman (Moderately active)														
	55.0	2200	9.2	29	750	2.5	0.9	1.3	14.5	200	2.0	30	0.4-0.5	14-28
Pregnancy (Later half)														
		+350	+1.5	38	750	10.0	+0.1	+0.2	+2.3	400	3.0	50	1.0-1.2	i
Lactation (first 6 months)														
		+550	+2.3	46	1200	10.0	+0.2	+0.4	+3.7	300	2.5	50	1.0-1.2	i

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

2017/18 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

AGF 4221
PROCESS CONTROL AND INSTRUMENTATION

Date: 11th JULY, 2018
Time: 14:00 - 17:00 HRS
Venue: VLT

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS A TOTAL OF FIVE (5) QUESTIONS.
2. EACH QUESTION CARRIES 25 MARKS.
3. ANSWER ANY FIVE (4) QUESTIONS.
4. ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOKLET PROVIDED
5. USE ILLUSTRATIONS AND SKETCHES IN YOUR ANSWERS WHERE NECESSARY

1.

a) List and briefly explain four hardware elements of a control system (Note: Do not give specific examples for each of these elements identified)

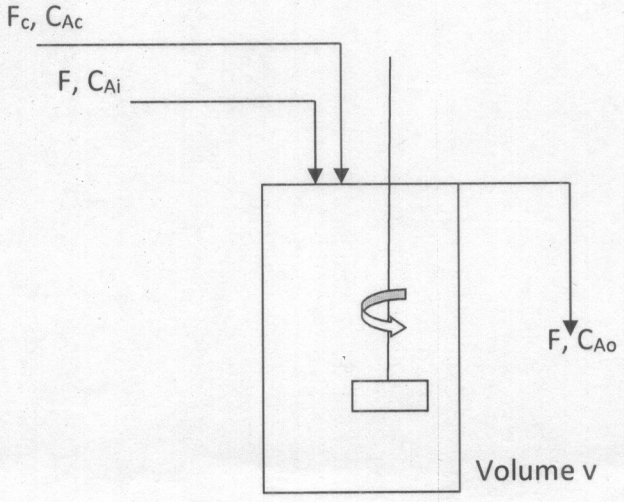
(8marks)

b) List and briefly explain four steps that are involved in developing a control scheme for the blending tank.

(8marks)

c) The diagram below shows concentration control in a blending tank. Develop a material balance of this system highlighting its deviation variables. Please show your work clearly.

(9marks)



2.

a) Discuss a system that exhibits first order dynamics and state its principle characteristics?

(6 marks)

b) With the help of a simple sketch, draw a tank operating in overflow with the volume constant. Develop a material balance for the same system given the following conditions;

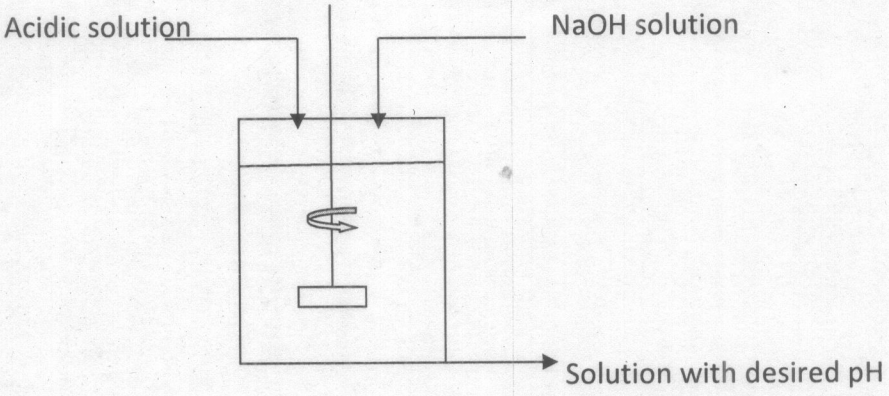
I. Inlet flow is constant in time

II. The concentration of the outlet stream is the same as the concentration in the tank.

(9 marks)

c) Design a control system for maintaining the pH of the liquid in a stirred tank, with the volume of the fluid in the tank kept constant. Further outline the objective of your control system? Develop a block diagram for this system (figure shown below).

(10 marks)



3.

a) Explain the importance of mathematical modelling in Process Control.

(6 marks)

b) Given the overall material balance of an ideal process of filling a tank is presented as below. Express the tank Volume in terms of the liquid level h (height of liquid in a tank) and hence find the liquid level h as a function of time.

$$\frac{d\rho V}{dt} = \rho F_i$$

(9 marks)

c) Develop a set of control algorithm for question **3 b** using the controller error for an automated control system involving measurement and action. Explain the significance of these algorithms as the controlled variable reaches the maximum or required value. (**Use algorithms to express your answer**)

(9 marks)

4.

a) List the Characteristics of a feedback control system. Develop a block diagram to illustrate this kind of system.

(6 marks)

b) Consider a system's response which is defined by $y = y_H + y_1 + y_2$. Given that y_H decays toward zero from IC, that y_1 is the response to a step disturbance occurring at $t_1 = 1$, with gain of 3 and y_2 is the response to a step disturbance occurring at $t_2 = 2$ with gain of -4. Give analysis of this system's response.

(9 marks)

c) Develop a block diagram of a two-input control system in a home shower with separate valves for hot and cold water who's main objective should be to obtain a desired temperature of the water and flow rate. What kind of a system is this? Explain its significance.

(10 marks)

5.

a) Distinguish Dead time from lag?

(6 marks)

b) What does the deviations from reference conditions represent and is it possible to recover the physical variables?

(9marks)

c) Given that the control objective for a process is to keep the store house temperature at a desired temperature on a thermostat, in spite of unmeasured disturbances such as heat loss from the doors and window openings, heat loss through the walls of the house. Develop a sketch showing all the necessary equipment working together.

I. Develop a block diagrams for this system.

II. Develop a set of control algorithm using temperature as one of the variables.

(10 marks)

END OF EXAMINATION

ADDITIONAL INFORMATION PROVIDED

The first-order ODE is as follows:

$$\tau \frac{dy}{dt} + y(t) = K\, x(t) \qquad y(t_0) = y_0$$

The solution is

$$y(t) = y_0 e^{-(t-t_0)/\tau} + \frac{K}{\tau} e^{-t/\tau} \int_{t_0}^{t} e^{\frac{t}{\tau}} x(t)\, dt$$

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DEPARTMENT OF FOOD SCIENCE AND NUTRITION

2018 ACADEMIC YEAR
MID-YEAR EXAMINATION

COURSE: AGF 5071
Food Colloids

Date: Friday, 13th July 2018 **Time: 14.00 – 17.00 Hours**

Duration: THREE (3) HOURS **Venue: Omnia 2**

INSTRUCTIONS TO CANDIDATES:

1. This paper has a total of **Seven (7)** questions and you are required to answer a total of **five (5)** questions
2. Answer **Question one (1) (Compulsory)** and **any other four (4)** questions of your choice
3. All marks allocated to each question are indicated at the end of each question
4. Note that some formulae and constants are given on the last page

Question 1 (Compulsory)

You are a Research & Development officer of a food manufacturing firm in Lusaka. The marketing department has identified an aqueous based drink and oily based drink. Investigations have revealed that a blend of these two drinks would produce a highly selling product. A blend ratio of aqueous-to-oily of 7:3 by volume has been found to be sensorially liked by consumers. The drink will also contain food additives.

(a) Propose food additives you would include in the formulation of this aqueous-lipid based drink. **(5 marks)**

(b) Give reason(s) why you are proposing those additives. In your explanation(s), include brief discussions on the stabilization or destabilization factors that each food additive works for or against, respectively. **(10 marks)**

(c) How do you propose to blend the two phases into one blended drink with its food additives (propose a flow-sheet to explain your answer, give reasons for each step in your proposed flow-sheet). **(10 marks)**

(d) Using the principles of colloidal science you have learnt, also state which of the two primary drinks is likely to be the continuous phase and why? **(5 marks)**

Question 2

(a) Write short notes on the following:

i. Marangoni effect
ii. Reverse micelle
iii. Critical Electrolyte Concentration
iv. Phase inversion
v. Protein bridging (**10 marks**)

(b) State three (3) sources of disruptive forces for a droplet during homogenization of a primary emulsion into a secondary emulsion? Out of the three, choose one, which you can describe/explain how that disruptive force breaks up the emulsion droplet? **(10 marks)**

Question 3

(a) (i) Define van der waals interactions
(ii) State and briefly explain three types of van der waals forces
(iii)Which of the three types is prominent and why? **(10 marks)**

(b) Colloidal classification can depend on the continuous phase. State three major classes of colloids depending on that classification. Out of the three, pick one and give three sub classes with a typical example of a food for each sub-classs **(10 marks)**

Question 4

(a) Surfactants aggregate spontaneously in solution to form a variety of thermodynamically stable structures known as association colloids. A common example of association colloids is a micelle. Associated with the micelle is the Critical Micelle Concentration (CMC). Explain and discuss the CMC concept including the effects of a surface active compound on the properties of a solution below the CMC, at CMC and above the CMC. **(10 marks)**

(b) A colloidal mill is one of the homogenizers used in the food emulsion industry to produce food emulsions. Explain how the colloidal mill works and state what type of raw material is suitable for the colloidal mill? **(10 marks)**

Question 5

(a) A droplet of corn oil is dispersed in an electrolyte solution of 0.1M of sodium chloride. With the help of defined model(s), explain how the ions will distribute themselves around the droplet and give a reason to your choice of distribution **(10 marks)**

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

(c) What is the difference between plastic and viscoelastic materials? **(4 marks)**

Question 6

(a) Calculate the required value of the stability ratio of Intra-lipid emulsions used for parenteral feeding in order to have a half-life of at least 2 years. These commercially available emulsions contain 20 g of purified soybean oil (δ=925 kg/m^3) as well as 1.2 g of purified egg lecithin (δ=1050 kg/m^3) per 100 ml of emulsion. The volume-equivalent particle diameter is 220 nm. It may be assumed that all lecithin is adsorbed to the O/W interface. The continuous phase is aqueous **(10 marks)**

(b) A new firm has embarked on producing a salad dressing. During their product development stage, they noted that on letting the salad dressing to stand, creaming was experienced after a period of twenty (20) hours. Their Research & Development (R&D) Manager advised them to include a polysaccharide, **Dextran**, as a stabilizer to stop the creaming. Initially, he advised them to use 0.05% of dextran but still experienced creaming within fifteen (15) hours. After further consultations, the R&D Manager advised them to increase the concentration to 0.25% at which the creaming was completely halted.

(i) Explain the reason for the creaming during the initial stage of product development **(3 marks)**

(ii) Explain the reason for the creaming experienced after addition of 0.05% dextran **(3 marks)**

(iii) Give the possible reason and the phenomenon responsible for stopping the creaming after addition of 0.25% **(4 marks)**

Question 7

(a) Liquid foods can be classified in different ways depending on the rheological behavior. State and explain the classification of liquid foods based on rheology with clear examples and importance of such classification in food processing **(10 marks)**

(b) A potential gradient of 20V/cm was applied across 0.2 mol/ dm^3 NaCl aqueous solution. A spherical particle of 1.0μm diameter was dispersed in this NaCl aqueous solution which was maintained at 25°C. The dispersed particles under these conditions were observed to be in motion and covered a distance of 140μm in 16 seconds. With the assumption that the viscosity of the water at 25°C was 0.89 Pa.s and the value of D was 78.55, estimate the:

(i) Electrophoretic mobility of the particle **(3 marks)**

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

End of Exam

(FORMULAE AND CONSTANTS OVERLEAF)

Formulae and constants for examination

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

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

$\Sigma = 1 / \Gamma$

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

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

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

$$\mu = \frac{\zeta * \varepsilon}{1.5\eta}$$ Debye – Hückel equation

$$\mu = \frac{\zeta * \varepsilon}{\eta}$$ Helmoltz-Smoluchowski equation

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

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

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

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

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

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

$t_{1/2,\ rapid} = 3*\eta / (4*k*T*N_o) = 2*10^{17} / N_o$

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

$F = 96485$ C / Mole

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

$R = 8.314$ J / (mole.K)

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

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

$N_A = 6.023 \times 10^{-23}$

δ_{H_2O} at 22°C ≈ 1000kg/m3

$g = 9.81$m/s

$\pi = 3.14$

$1dm^3 = 0.001m^3$

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

BACHELOR OF FOOD SCIENCE AND TECHNOLOGY

PLANT DESIGN AND ENVIRONMENTAL MANAGEMENT
AGF 5241

2017-2018 MID-YEAR EXAMINATIONS

DURATION: THREE (3) HOURS **VENUE: OMNIA 1**

INSTRUCTIONS TO THE CANDIDATES:

1. PLEASE READ THE INSTRUCTIONS AND EACH QUESTION CAREFULLY.
2. THIS PAPER HAS **FOUR** QUESTIONS AND EACH CARIES **25 MARKS**
3. ANSWER ALL QUESTIONS.

1. A newly built warehouse for masuku fruit with the storage capacity of 2500 Kg of the fruit has the following dimensions: 9m (length), 5m (width) and 4m (height). In order to maintain the product integrity, the warehouse require the installation of air-conditioning and ventilating accessories. The respective k-values of the roof, the walls and the floor are 0.8, 1.2 and 1.4 $W.m^{-2}.\ ^{o}C^{-1}$ and the air is supplied into the room at a rate of $0.20 m^3/s$

   Optimum conditions and relevant parameters for masuku storage are given below:

   - γ = Air density = 1.2 $kg\ DA/m^3$
   - C_p = Specific heat of dry air = 1.004 $kJ/kgDA.^{o}C$
   - T_{opt} = 13 ^{o}C
   - H_V = 0.118 $W.kg^{-1}$
   - Tolerable CO_2 concentration = 8 L/m^3, CO_2 concentration of open air = 0.35 L/m^3
   - CO_2 production = 0.25 L/kgs

   a) Calculate the amount of cooling or heating required for 2500 Kg of masuku at outside temperatures of 5 and 10 °C. The floor is assumed to be adiabatic. **(12 points)**

   b) Is there need for gas scrubbing or addition in order to maintain the given optimum CO_2 concentration for masuku? **(7 points)**

   c) Describe briefly the process of humidification and dehumidification **(6 points**

2. Preliminary design work has been done on a process to recover a valuable food product from an effluent gas stream. The gas will be scrubbed with a solvent in a packed column; the recovered product and solvent separated by distillation; and the solvent cooled and recycled. The major items of equipment that will be required and their costs are listed below:

- Absorption column	29,000 USD
- Recovery column	64,000 USD
- Reboiler	8000 USD
- Condenser	6000 USD
- Cooler	3000 USD
- Solvent tank	10,000 USD

- Product tank 10,000 USD

It is estimated that the recovery rate of the product from the liquid raw material is 70 % and the plant has the capacity to process 200,000 Litres of the raw material per annum. The valuable food product from this process is valued at ZMW 100/Litre and the annual operation costs, rounded = ZMW 1,320,000. The exchange rate is 1 USD = 10 ZMW

a) Calculate the total investment cost for this project **(8.5 points)**

b) Is this investment worth risking your money? Justify your answer. **(8.5 points)**

c) Using the project cash flow diagram, summarise the phases that a project such as this may follow during its life cycle **(8 points)**

3. A potential investor would like to set up a sugar processing plant in Zambia and has approached you as plant design engineer to do a market and location survey.

   a. Briefly discuss five forces in the marketing environment that you would consider important and that would have an impact on this firm. **(6 points)**

   b. In doing your market research, you may decide to use mail, telephone or personal contact methods. What are the advantages and disadvantages of each of these contact methods? **(8 points)**

   c. Differentiate between structured and non-structured research method. **(6 points)**

   d. Provide an insight to your client by giving a brief marketplace analysis. **(5 points)**

4. You have just started your first job as a plant design engineer at IMUKA Dairy Ventures. Your supervisor presents you with two assignments:

   - To procure the equipment
   - Provide an insight on various features of the newly built cheese factory

   a. Discuss three attributes that you may generally consider important when selecting food processing equipment. **(5 points)**

   b. Give your expectations on the following

      i. arrangement of rooms, areas and processes within the establishment. **(5 points)**

      ii. Structural components (wall, floor, window, pipelines and doors. **(7 points)**

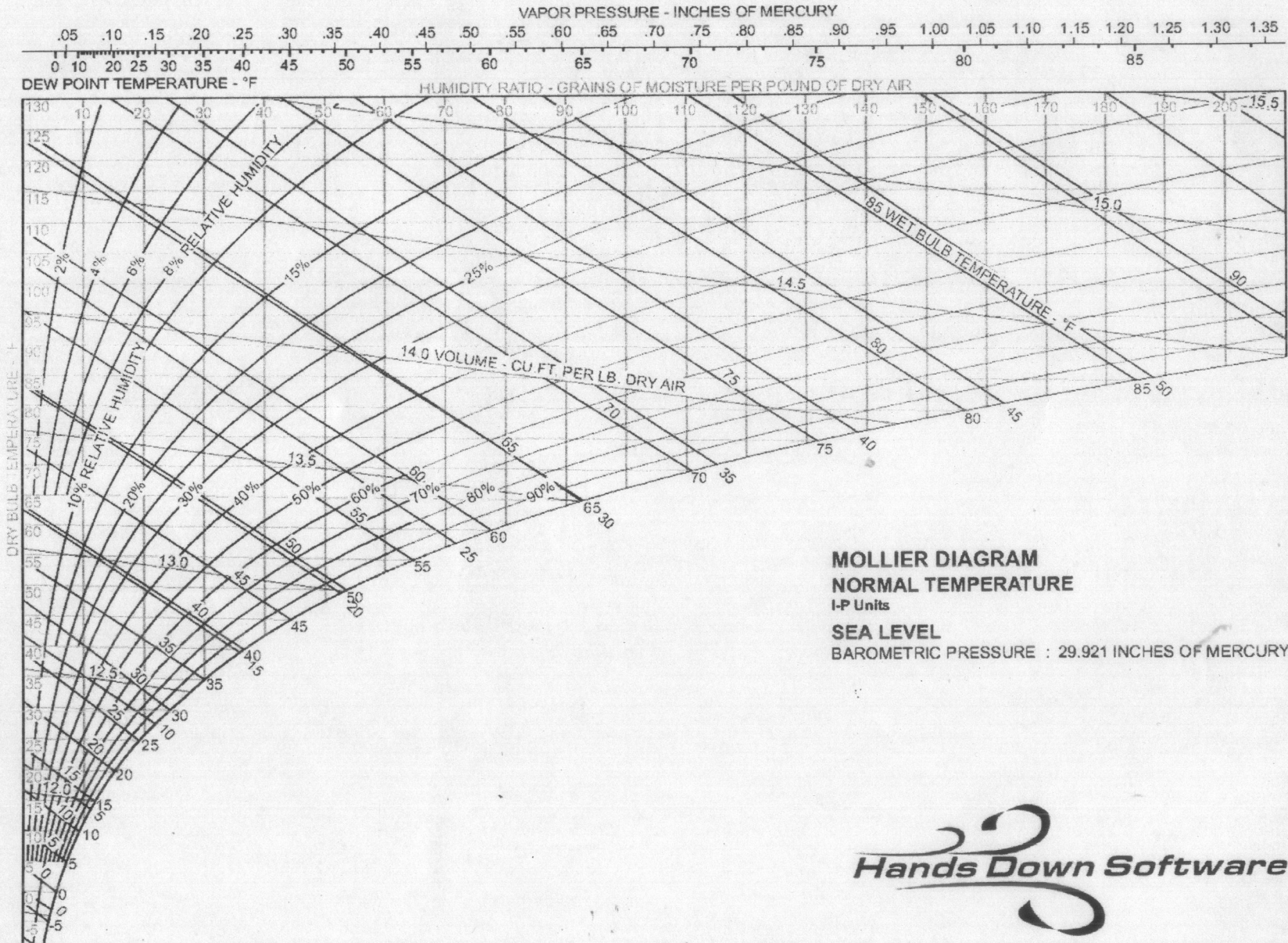
      iii. Process flow diagram (hint: what you expect to be included on the process flow diagram of this single process unit) **(8 points)**

END OF EXAMINATION

ANNEX

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

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



MOLLIER DIAGRAM
NORMAL TEMPERATURE
I-P Units

SEA LEVEL
BAROMETRIC PRESSURE : 29.921 INCHES OF MERCURY

Hands Down Software

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

2017/18 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

AGF 5321
Technology of Dairy & Egg products

Date: Tuesday 3rd June 2018
Time: 09:00hrs
Venue: OMNIA 3 Lecture Theatre

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS TWO (2) SECTIONS.
2. ANSWER ALL QUESTIONS IN SECTION 1 AND SECTION 2.
3. ANSWER THE TWO SECTIONS IN SEPARATE ANSWER BOOKLETS.
4. ALLOCATED MARKS FOR EACH QUESTION ARE INDICATED IN BRACKETS.

SECTION 1: Technology of Dairy Products

1. The manager of Mongu Dairy Cooperative approaches you for technical assistance to develop to a proposal for the production stirred fruit yoghurt. As a dairy expert:
    a. Explain with aid of an illustration, the manufacturing process of stirred fruit yoghurt. **[15 marks]**
    b. State the changes (including new equipment) that should be made to this production line in order to produce flavoured set yoghurt. **[3 marks]**
    c. Explain the symbiotic relationship of the yoghurt starter culture. **[2 marks]**

2. Samrosa Dairy Products is involved in the manufacture of skimmed milk powder using roller dryers. The company's technical manager approaches you with a problem of their product forming lumps in hot beverages like tea or coffee when added.
    a. Explain the possible causes of the problem. **[3 marks]**
    b. Give the possible solutions and offer recommendations. **[3 marks]**
    c. Give two alternative suitable uses of the current product. **[2 marks]**
    d. Describe the butter making process. **[12 marks]**

3. For each of the following:
    a. Discuss the classification of cheese and give an example for each class. **[6 marks]**
    b. Explain the importance of homogenisation and aging in the ice-cream making process. **[4 marks]**
    c. Discuss the difference between sweetened and unsweetened condensed milk. **[4 marks]**
    d. Compare the effect of heat treatment on the nutritional value of pasteurised, sterilised and UHT milk. **[3 marks]**
    e. Describe the cleaning stages of equipment in a dairy plant. **[3 marks]**

SECTION 2: Technology of Eggs – Answer all questions in a **separate booklet.**

1. As a new manager specifically employed to improve the quality of eggs for Maaka Foods, you have been tasked to write a Lab Manual for Egg Quality. Explain how you would write the appropriate quality information for the following attributes:
   a. the external and internal quality of eggs,
   b. the pH of eggs,
   c. total solids,
   d. seven weight grades associated with Classes A and B **[20 marks]**

2. a. Explain the significance of α-amylase in egg processing. **[5 marks]**
   b. Name and describe **four** characteristics of egg oil and their figures. **[5 marks]**
   c. Explain the significance of de-sugaring in egg processing. **[5 marks]**
   d. Additional quality factors that may not be apparent by sensory observation are nutritional and sanitary quality. Explain how these relate to egg quality. **[5 marks]**

UNIVERSITY OF ZAMBIA

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DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

JULY 2018

FINAL EXAMINATION

PROCESSING AND PRESERVATION OF PLANT PRODUCTS

AGF 5615

DATE: 5TH JULY, 2018

TIME: 14.00 – 17.00 hours

DURATION: THREE (3) HOURS

INSTRUCTIONS

1. Students are NOT permitted to bring mobile phones and/or any other unauthorized electronic devices into the examination room.
2. Write your student number in the space provided on the answer booklet.
3. Answer all questions.
4. Each question must be answered in a separate booklet.
5. All questions carry a total of 25 marks each.
6. Answer **all** questions. Each question must be answered in a separate answer booklet.

1. (a) Production of sauerkraut undergoes spontaneous fermentation that highlights the importance of selective and elective conditions

(i) Name three advantages of fermentation. **(3 marks)**

(ii) Explain the difference between elective and selective conditions in the fermentation of sauerkraut. **(2 marks)**

(iii) Why would you not possibly find gram negative bacteria in lactic acid fermented foods and why are they common organisms on fresh vegetables? **(5 marks)**

(iv) Why would you prefer homofermentative bacteria than heterofermentative bacteria in the production of yogurt? **(2 marks)**

(v) On what ground would you have reservations to recommend spontaneously fermented beverage as a weaning drink for children despite considered as nutritious. **(3 marks)**

(b) In the production of beer, malting of barley is inevitable, addition of wort is desirable, supplementing with adjuncts is ideal and single strain fermentation is a must.

(i) Discuss why malting of barley is inevitable **(2 marks)**

(ii) Single strain fermentation is a must **(2 marks)**

(iii) Addition of wort is desirable **(2 marks)**

(iv) Supplementing with adjuncts is ideal **(2 marks)**

(c) Beer processing is a big business that has helped to drive the economy and yet its influence has claimed many dependable human personnel and bread winners. Would you be for or against the production of beer. State your reason. **(2 marks)**

2. Cereals and grains are widely cultivated and make up an important component of the human diet.

a) Discuss one cereal of economic importance throughout the world. **(6 marks)**

b) Discuss the attributes of flour that make it good for making bread or biscuits.

(2 marks)

c) What are the four classes of cereal protein? **(2 marks)**

d) What are the difference between the starch digesting enzymes alpha and beta amylase? **(2 marks)**

e) Oil is an important component of the human diet. It makes food palatable and gives it attractive sensory attributes.

i) What is the composition of oil? **(5 marks)**

ii) How does the composition affect the nutritional attributes? **(4 marks)**

iii) Name two oils that are obtained from fruit pulp. **(2 marks)**

iv) Write short and concise notes on the following (in less than five lines)

a) Desolventizer toaster **(1 mark)**

b) Soy milk **(1 mark)**

3. (a) Describe the processing of sugar from sugar cane step by step and include by products, How does it differ from the processing of sugar from beet root. **(15 Marks)**

(b) In starch hydrolysis, describe briefly how liquifacts or Maltodextrins products are produced. **(5 Marks)**

(C) What do the following mean?

(i) DP value and when it has a numeral suffix e.g. DP_1 **(2 Marks)**

(ii) Retrogradation **(2 Marks)**

(iii) HFCS **(1 Mark)**

4.

a. Explain the manufacturing process of a mango juice concentrate with aid of a flow diagram. **(15 Marks)**

b. The manager of Magesth frozen foods limited approaches you with a problem of bulging canned peas after a week of production. Explain the causes of the problem and offer possible solutions. **(5 Marks)**

c. Identify and briefly explain the most critical differentiating **pre-drying step** for cabbage and banana for the production of a good quality product in terms of colour, texture and nutrition. **(5 Marks)**

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF AGRICULTURAL ECONOMICS & EXTENSION

2017/2018 ACADEMIC MID YEAR FINAL EXAMINATION

AGG 3811: RURAL SOCIOLOGY

DATE: **TOTAL MARKS: 100**

TIME: THREE HOURS

INSTRUCTION: ANSWER ALL QUESTIONS. EACH QUESTION CARRIES EQUAL MARKS

1. With at least **ONE** known example discuss each one of the five common forms of social interaction as is understood by Sociologists (20 marks)

2. "The word bureaucracy refers to any organization that has many departments or bureau.
   a) Using Max Weber's model outline and explain any **FIVE** ideal characteristics of bureaucracy (10 marks)
   b) With practical examples, explain the terms "traditional" and "charismatic" authority (6 marks)
   c) Briefly state why bureaucracy is more superior over other known forms of authority (4 marks)

3. Explain the definitional differences between the following concepts:
   a) Social stratification and social change (4 marks)
   b) Sacred and secular association (4 marks)
   c) Mechanical and organic solidarity (4 marks)
   d) Rationalization and formalization (4 marks)
   e) Psychology and anthropology (4 marks)

4. The family is defined as 'a kinship grouping which provides for the rearing of children and for certain other human needs."
   a) State the differences between nuclear and extended family and between monogamous and polygamous forms of marriages (8 marks)
   b) Briefly describe any **FOUR** functions of the family (8 marks)
   c) State at least **TWO** known cultural threats that mass media poses on the current Zambian families.

5. Based on the major characteristics of Sociology, explain to a non- social scientist what Sociology is?

----------END----------

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – NOVEMBER 2020

AGG 3822

AGRICULTURAL EXTENSION

TIME: 1½ Hours Marks: 100

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

SECTION A: MULTIPLE –CHOICE QUESTIONS- (MARKS 20)
(ANSWER ALL QUESTIONS)

1. In what **order** do managers typically perform the managerial functions?
   a) organising, staffing planning, controlling, leading
   b) organising, planning, staffing controlling, leading
   c) planning, organising, staffing, leading, controlling
   d) planning, organising, controlling, staffing leading

2. The word..... denotes a function, a task, a discipline.
   a) Management
   b) Leadership
   c) Motivation
   d) None of the above

3. Result demonstration is a...?
   a) Mass contact.
   b) Group contact.
   c) Individual contact.
   d) None of the above.

4. What is the correct percentage of late adopters?
   a) 18%.
   b) 14%.
   c) 19%.
   d) 16%.

5. Main objective of agricultural extension during colonial period was?
   a). Supporting cultivation of fruit crops.
   b). Supporting cultivation of flower crops.
   c). Supporting cultivation of crops like sugar, coffee, and cotton.
   d). Supporting cultivation of vegetable crops.

6. What is team-building in terms of staff members?
   a) Selecting the plays of your fantasy football team
   b) Gathering workers from around the world to make the perfect team
   c) Creating a greater sense of trust and support among staff
   d) None of these answers are correct.

7. What are the three interpersonal roles of managers?
   a) Figurehead, leader and liaison
   b) Spokesperson, leader, coordinator
   c) Director, coordinator, disseminator
   d) Communicator, organiser, spokesperson

8. _____ refers to the meaning that society attaches to being male or female.
   a) Sex
   b) Gender
   c) Sexual Identity
   d) Sexual Orientation

9. According to world systems analysis, where are poor and developing nations found?
   a) On the periphery
   b) On the semi periphery
   c) In external areas
   d) At the center

10. Which of the following is an example of a community (move to rural sociology)
   a) Family
   b) Marriage
   c) Village
   d) Refugee Camp

Section B: True / False Questions

1. Extension is a continually developing field constantly adapting to the needs of rural producers.
   A) True
   B) false.
2. Innovation system in agriculture involves multiple actors such as farmers, producers' organizations and cooperatives, private companies in supply and value chains, extension services and national research organizations.
   A) True
   B) False
3. The decentralisation of extension services has made public extension services unnecessary.
   A) True
   B) False
4. Resource allocation and disturbance handling are both considered decisional roles.
   A) True
   B) False
5. Communication is a key tenant of innovation diffusion theory
   A) True
   B) False
6. Input agencies, farmer organisations and NGOs are not recognised as extension services.
   A) True
   B) False
7. A rule is a formal, written guide to action.
   A) True
   B) False
8. The process by which managers select goals and courses of action for the organization is called _____
   A) True
   B) False

9. Evaluating the success of the strategy is the last step in the planning process.
   A) True
   B) False
10. In order to be considered a manager, an individual must coordinate the work of others.
   A) True
   B) False

SECTION C: SHORT ANSWERS (60 MARKS)
(ANSWER ALL QUESTIONS)

1. Based on four principles, show how Participatory approach is distinguished from the Training and Visit System (20 marks)

2. Identify all "Ideal types" of adopter categories in the diffusion of innovations and for each category briefly explain the adopter innovativeness, advantages and disadvantages associated with working with such an adopter category (20 marks)

3. Describe the five sequential management functions indicating how these help in the design and operational efficiency of an extension organization (20 marks)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2019/2020 DEFERRED EXAMINATIONS

COURSE : **AGG 3832 FORAGE CROP PRODUCTION AND RANGE MANAGEMENT**

DATE : **13TH JANUARY 2021 14:00 HOURS**

DURATION : **1 HOUR 30 MINUTES**

INSTRUCTIONS : **ANSWER ANY THREE QUESTIONS**

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1. Rangeland degradation consists of a reduction in the quantity or nutritional quality of the vegetation available for grazing. The prospect of increased rangeland degradation is common to all dryland areas. In particular, the deterioration is more advanced in semi-arid and sub-humid areas than in arid areas.
   a) What are the characteristics of range lands? (4 marks).
   b) Outline the importance of rangelands in Zambia (6 marks).
   c) What measures should be carried out to improve the productivity of rangelands in Zambia? (10 marks).

2. Pasture grasses and legumes are an importance component of the ecosystem in grazing lands.

   a) Give examples of any three pasture grasses and two pasture legumes. Please indicate their scientific names as well. (5 marks).
   b) Mention and explain five differences between pasture grasses and legumes (10 marks).

3. Hay is the oldest, and still the most important, conserved fodder, despite its dependence on suitable weather at harvest time. Meeting the feed requirements of each class of cattle is important in producing productive and healthy livestock. To do this, you need to understand both the feed requirements of your cattle as well as the value of the available feed.
   a) List down the important steps involved in the production of good quality hay (8 marks).

b) What are the characteristics of good quality hay (12 marks).

4. a) Define an ecosystem (5 marks).
   b). What are the components of an ecosystem in rangelands (9 marks).
   c) What are ecosystem goods and services. Explain and give examples (6 marks).

5 A farmer in Choma has the following herd of cattle 6 Tonga bulls, 150 Angoni Cows and 10 Angoni heifers. He has 10 hectares of field crops, 30 hectares of citrus fruits, 900 hectares of natural grazing land. **Take 1 Livestock Unit to 5 hectares**

a) Define stocking rate (5 marks).
b) Comment on the stocking rate (10 marks). Please show all calculations.
c) What would be your advice to this farmer (5 marks).

Livestock Units of Different Breeds of Cattle

Breed	Cow	Bull	2-3 Years	1-2 Years	5-11 Months	0-5 Months
Brahman, Simmental	1.5	1.8	1.5	0.8	0.4	0.2
Hereford, Sussex, South Devon	1.3	1.6	1.3	0.7	0.3	0.2
Africander, Boran, Friesian	1.2	1.4	1.2	0.6	0.3	0.2
Barotse, Gurnsey	1.0	1.2	1.0	0.5	0.3	0.1
Tonga, Angoni, Jersey	0.9	1.1	0.9	0.5	0.2	0.1

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS - JULY 2019

AGG 4851

EXPERIMENTAL DESIGN AND STATICTICAL ANALYSIS

TIME: 3 Hours **Marks 100**

INSTRUCTIONS: ANSWER ALL THE QUESTION. ANY STATISTICAL TESTS SHOULD BE AT 5% SIGNIFICANCY LEVEL.

Question 1

An Animal Breeder wanted to estimate sire, daughter and error variance components for milk yield from the daughters' four lactations. She collected the following milk records.

Sire	Daughter	Lactation Milk Yield (Kg)			
Bull One	Daughter One	15	20	13	10
	Daughter Two	9	12	14	11
Bull Two	Daughter One	10	14	15	20
	Daughter Two	21	18	19	15

a) Write a Linear Model for this data. (**6 Marks**).
b) Analyse the data. (**16 Marks**).
c) Estimate the variance components. (**3 Marks**).

Question 2

In a study of the effect of times of irrigation and fertilizer rate on the yield (kg) of tomatoes a split-plot design was used under randomised complete block experimental design (RCBD). Irrigation times (once and twice irrigation) were randomly assigned to the main plots. Fertilizer rate (0 fertilizer and 25 kg of D compound) were randomly assigned to the sub-plots. At the end of the experiment the following data was collected:

IRRIGATION TIMES				
REPLICATION	ONCE		TWICE	
	0 D Compound	25kg D Compound	0 D Compound	25kg D Compound
1	33	42	42	46
2	25	40	35	47
3	30	30	32	38

a. Write the appropriate linear model for this data. **(6 Points).**
b. Analyse the data. **(16 Points).**
c. Make any necessary recommendations. **(3 Points).**

Question 3

Given observations Y_{ijk} of an experiment, in which data is balanced and where:

k stands for the k^{th} observation for a given treatment such that k = 1, 2, 3, ..., n;

j stands for the j^{th} level of factor A such that j = 1, 2, 3, ..., a; and

i stands for the i^{th} level of factor B such that i = 1, 2, 3, ..., b.

In this experiment:

a) State the number of treatments, in an expression form. **(2 Marks)**
b) State the number of replications, in an expression form. **(2 Marks)**
c) Write an expression, in summation notation, for the overall total of observed values. **(3 Marks)**
d) Write an expression, in summation notation, for the totals of observed values for factor A levels. **(2 Marks)**
e) Write an expression, in summation notation, for the totals of observed values for factor B levels. **(2 Marks)**
f) Write an expression, in summation notation, for the totals of observed values for treatments. **(1 Mark)**
g) Write an expression, in summation notation, for the treatment means. **(3 Marks)**
h) Write an expression, in summation notation, for the overall mean. **(4 Marks)**
i) Write and expression, in summation notation, for treatment effect. **(6 Marks)**

Question 4

Loss of weight, by cattle, during the dry season is a major problem to the small scale farmers. The Ministry of Livestock and Fisheries would like to come up with a recommendation on dry season supplementation. Hence, an experiment was conducted at Mochipapa Regional Research Station knowing full that Breed can influence the outcome of the supplementation experiment. The 100 days weight gain, in kg, of the male yearlings was recorded as follows.

	Breed		
Supplementation	Angoni	Tonga	Barotse
No supplement:	60	65	71
Limited grain supplement	71	70	83
Full grain supplement	84	90	99

a) Write a Linear Model for this experiment. (**9 Marks**)
b) Analyse the data in a way that you would if you were a Research Scientist at the Mochipapa Regional Research Station. (**12 Marks**)
c) Make any meaningful recommendation(s) that can be reported to the Ministry of Livestock and Fisheries. (**4 Mark**)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

BSc HUMAN NUTRITION

AGN 3222
HUMAN NUTRITION

2019/2020 DEFERRED END OF YEAR EXAMINATIONS

Date: 11th January 2021

Time: 09:00 to 10:30 hours

Duration: 1hour 30 minutes

Venue: Sports Hall

INSTRUCTIONS TO CANDIDATES:

1. There are THREE (3) Questions in this examination paper
2. Answer all questions

QUESTION 1 (20 MARKS)

a) With respect to the following nutrients, explain how the nutritional requirements change during pregnancy;
   i) Calories (**2 marks**)
   ii) Protein (**1 marks**)
   iii) Folate **(1 marks**)
   iv) Iron (**1 marks**)

b) Increasingly, breastfeeding advocates present breastfeeding as the best option for feeding babies. State five (5) reasons each as to why breastfeeding has benefits for; the mother, the infant and for the environment.
   i) The mother (**5 marks**)
   ii) The infant (**5 marks**)
   iii) The environment (**5 marks**)

QUESTION 2 (20 MARKS)

a) Calculate the number of calories in the following meal
150g (25g Protein) fried Tilapia with 1.5g Oil + 1 cup cooked pumpkin leaves + 1 cup cooked brown rice (45g carbs) **(6 marks)**

b) Convert the following to kilocalories;
   i) 7600 kilojoules (**2 marks**)
   ii) 65g of CHO (**2 marks**)

c) Briefly describe five (5) nutritional concerns in older adults (**10 marks**)

QUESTION 3

a) Discuss dietary diversity citing examples of how it can be achieved at household level (**10 marks**)

b) State five (5) uses and five (5) limitations of food composition data tables (**10 marks)**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

2017/2018 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

BSc Human Nutrition

COURSE: AGN 3311

NUTRITION ASSESSMENT

Date: 9TH JULY 2018 **Time: 09.00 – 12.00 HRS**

Duration: THREE (3) HOURS **Venue: VLT**

INSTRUCTIONS TO THE CANDIDATES:

1. **THIS PAPER HAS TWO SECTIONS: SECTION A AND B**

2. **ANSWER ALL QUESTIONS IN SECTION A. IN SECTION B, ANSWER FOUR QUESTIONS, TWO QUESTIONS FROM PART B1 AND TWO QUESTIONS FROM PART B2.**

3. **ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN BRACKETS.**

Section A: Answer all questions in this section (Total marks: 20)

1 List two field based methods of biochemical analysis that can be used to diagnose iron deficiency anemia in individuals? (2 marks)

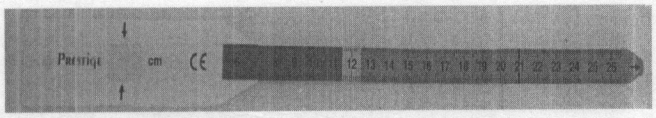
2 What are the WHO cut-offs that would apply to define the iron status of women of child bearing age (2 marks)

3 List any two biochemical methods that can be used to assess zinc deficiency? (2 marks)

4 Name any four software tools that can be used to analyze dietary data (2 marks)

5 State four sources of measurement error in food consumption surveys. (2 marks)

6 Identify the following pieces of equipment and their uses ($^1/_2$ mark each)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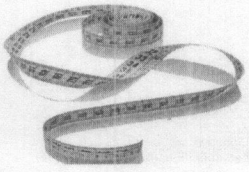
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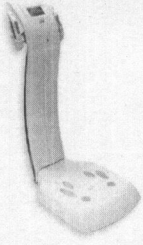
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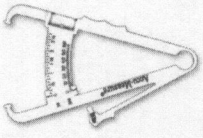
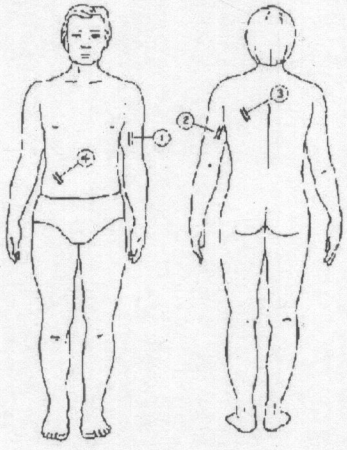

e

7. Name the parts (1, 2, 3 and 4) indicated in the diagrams below for measuring skin-fold thickness ($^1/_2$ mark each)



8. Head circumference is an anthropometric measurement used for defining brain growth and development in infants and children under the age of two (2) years (true or false) (1 mark)
9. Anthropometry involves…… (Complete the statement) (1 Mark)
10. Clinical examination involves …….. (Complete the statement) (1 mark)

Section B (Total 80 Marks): Answer four (4) questions; two (2) from part B1 and two from part B2. All questions carry 20 marks each

PART B1

Question 1

a. What is a nutrition indicator? (1 mark)
b. What purpose do nutrition indicators serve? (2 marks)
c. Outline the characteristics of a good nutrition indicator (4 marks)
d. Identify nutrition indicators used in classifying under nutrition in children less than five years of age and over nutrition in adults (8 marks)
e. Discuss the limitations of body mass index [BMI] (5 marks)

Question 2

a. Outline the age categories of the elderly (2 marks)
b. Discuss the effects of aging (3 marks)
c. Outline the physiological changes associated with aging that affect Nutrition status (4 marks)
d. Identify the measurement difficulties associated in the geriatrics (4 marks)
e. Discuss the factors that affect the aging process (4 marks)
f. What is the position concerning the elderly in Zambia? (3 marks)

Question 3

a. Define the following terms (1 mark each)
    i. Instrument
    ii. Measurement
    iii. Standard
    iv. Error
b. Identify the sources of error in nutritional anthropometry (3 marks)
c. Discuss the different types of measurement error and how these can be minimized (6 marks)
d. Using specific examples, distinguish between precision and accuracy (4 marks)
e. Distinguish between systematic and random errors (3 marks)

PART B 2

Question 4

a. WHO is conducting a national survey in Zambia with the objective of establishing micronutrient gaps in children under 5 years of age. As a consultant in this study, provide advice on the appropriate technique/tool that would be used to collect dietary data. Explain how this technique is used in data collection and how you would proceed to analyze the data to address the research objective. (8 marks)

b. What are the shortcomings of using the technique identified in (a) above and how can they be overcome (4 marks)

c. Outline and briefly explain four factors that determine the absorption and utilization of nutrients by the human body. (8 marks)

Question 5

a. Explain the following indicators used in food consumption surveys. In each case explain how each indicator is determined and interpreted.

   i. Food consumption score (5 marks)

   ii. Household dietary diversity score (5 marks)

   iii. Minimum dietary diversity score for women (4 marks)

b. Explain why associations between dietary diversity and nutritional status should be interpreted with caution? (6 marks)

Question 6

Discuss the weighed food records and Food frequency questionnaire as methods of dietary assessment. For each method outline three challenges in collection, analysis and interpretation of dietary assessment data. (20 marks)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

BSC HUMAN NUTRITION

NUTRITION DISORDERS
AGN 4241
2017/ 2018 MID-YEAR EXAMINATIONS

DATE: 10TH JULY, 2018 **TIME: 09 – 12:00H**

DURATION: THREE (3) HOURS **VENUE: OMNIA I**

INSTRUCTIONS TO THE CANDIDATES:

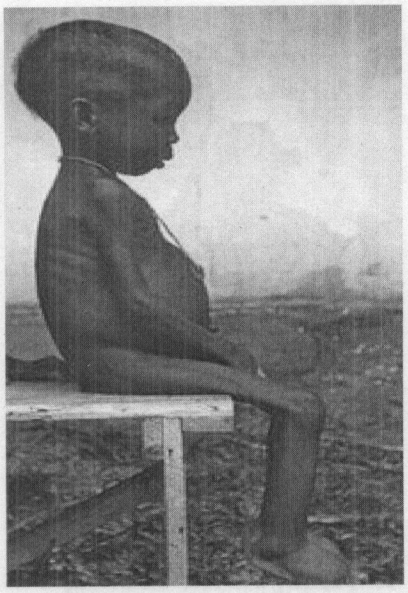
1. **THIS PAPER CARRIES 100 MARKS AND HAS TWO (2) SECTIONS; SECTION A AND B**

2. **ANSWER ALL QUESTIONS IN SECTION A. CHOOSE ANY THREE (3) QUESTIONS FROM SECTION B**

3. **ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS**

SECTION A – 25 marks

1. Macronutrients are needed in large quantities to provide energy and building materials to the body **(true or false)** **(1 mark)**
2. Describe the effect of aldosterone hormone on sodium and potassium in the maintenance of blood pressure **(2 marks)**
   a. How does an increase in this hormone prevent osteoporosis? **(1 mark)**
3. In the 1950s, Cecily Williams described "kwashiorkor" as a problem of the weaned child **(true or false)** **(1 mark)**
4. Excess ..... stimulates hypertrophy and hyperplasia which are defined as ..... **(5 marks)**
5. Define dyslipidemia **(1.5 marks)**
6. How does a deficiency in Vitamin C affect the structure of collagen? **(1 mark)**
7. Define the term "thrifty metabolic genes" in obesity **(2 marks)**
8. "*Hidden hunger*" is a term describing deficiency of macronutrients **(true or false)** **(1 mark)**
9. Identify and briefly discuss the clinical features in the following pictures: **(9.5 marks)**



a

b

SECTION B – 25 marks each

Question 1

a) Libati has developed an orange ring around the cornea of his eye with other liver complications. His Doctor diagnoses him with Wilson's disease and prescribes zinc for his condition.

i. What micronutrient is associated with Wilson's disease? **(1 mark)**

ii. Why did the Doctor prescribe zinc for this condition? **(2 marks)**

iii. What is the name of the structure that zinc forms in trying to reduce the symptoms of Wilson's disease? **(1 mark)**

iv. Name two (2) ways in which zinc supplementation reduces the symptoms of diabetes **(2 marks)**

v. Zinc falls into one of the three (3) major components of the treatment of diabetes. Name these three (3) components and identify which component zinc falls in **(4 marks)**

b) Breast cancer is a very slow growing cancer that can take many years before it can manifest. After screening, Angela is found with a lump which may be cancerous.

i. Name the three general stages of carcinogenesis **(3 marks)**

ii. Provide four (4) recommended ways for Angela to prevent cancer **(4 marks)**

iii. Apoptosis is an important part of the healing process for Angela and is promoted by several different types of phytochemicals

A. Define apoptosis **(1 mark)**

B. Describe the four (4) ways in which phytochemicals in plant-based foods prevent the onset/ progression of cancer **(4 marks)**

C. Provide two (2) advantages and one (1) possible disadvantage of consuming soy in Angela's condition **(3 marks)**

Question 2

a) Outline the dietary causes of anaemia **(3 marks)**

b) Identify the factors that aid iron absorption **(3 marks)**

c) What are the determining factors of non-haem iron absorption by the body? **(4 marks)**

d) Identify the population groups at risk of iron deficiency anaemia **(4 marks)**

e) Outline the roles of iron in the body **(5 marks)**

f) Briefly discuss the clinical signs and symptoms of iron deficiency anaemia **(6 marks)**

Question 3

a) Consider figure I below which can be used to explain ketoacidosis

i. Name the products labeled A, B, C and D **(2 marks)**

ii. In ketoacidosis, there is a shortage of product A. Why does this happen? **(5 marks)**

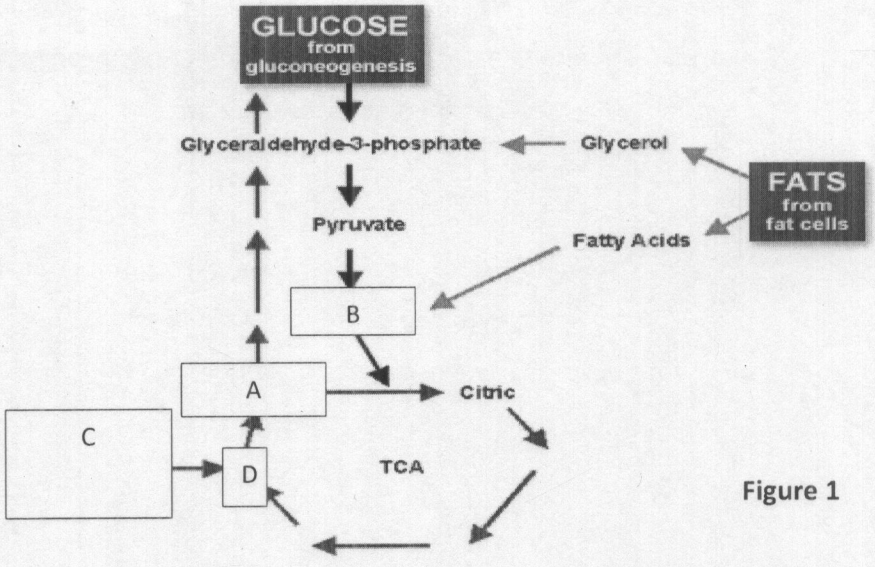


Figure 1

b) Diabetes is considered an intermediate risk factor for coronary heart disease which generally begins as atherosclerosis

i. Explain how diabetes (high blood glucose) may initiate the onset of atherosclerosis **(2 marks)**

ii. Name two (2) lipoproteins that may also initiate the onset of atherosclerosis if found in high amounts **(2 marks)**

iii. Describe in detail the progression of atherosclerosis **(8 marks)**

iv. Provide three (3) beneficial effects of niacin in heart disease **(3 marks)**

v. If an individual has been prescribed with niacin for the control of heart disease, which amino acid would you recommend that this individual consumes in higher amounts and why? **(2 marks)**

vi. Identify two (2) foods rich in the amino acid you have identified in v. above **(1 mark)**

Question 4

a) Discuss the functions of vitamin A **(4 marks)**

b) Identify the population groups at risk of vitamin A deficiency **(6 marks)**

c) Discuss the signs and symptoms of vitamin A deficiency **(6 marks)**

d) Explain the factors that facilitate vitamin A deficiency **(3 marks)**

e) Outline the benefits of vitamin A **(3 marks)**

f) Provide dietary sources of vitamin A **(3 marks)**

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE & NUTRITION

BSc HUMAN NUTRITION PROGRAMME

2018/2019 ACADEMIC YEAR

MID-YEAR EXAMINATIONS

COURSE:

AGN 4321: RESEARCH METHODS AND EPIDEMIOLOGY FOR NUTRITIONISTS

DATE: 11TH JULY 2019 **VENUE: VLT**

TIME: 14.00 – 17.00HRS

INSTRUCTIONS TO THE CANDIDATES:

1. **THIS PAPER HAS TWO SECTIONS: SECTION A AND B**
2. **ANSWER ALL QUESTIONS IN BOTH SECTIONS IN THE BOOKLETS PROVIDED.**

SECTION A: RESEARCH METHODS (50 MARKS)

Question 1 (20 marks)

a. Briefly explain the following sampling procedures and suggest an example of a situation where each of them can be applied. **(12 marks)**

   i. Stratified random sampling
   ii. Chain sampling
   iii. Simple random sampling

b. State and briefly explain any four data collection methods utilised in qualitative studies. **(8 marks)**

Question 2 (20 marks)

a. Describe two approaches that can be used to develop the "Problem Statement" sub-section of a research proposal for the following research topic: "Dietary assessment of vitamin A and iron among pregnant women in Mansa district Hospital in Zambia." **(8 marks)**

b. Using any one approach in (a) above, write the Problem Statement for the research topic in (a) above (8 marks)

c. State three possible objectives for the study topic in (a) above. **(3 marks)**

d. What research design would be applied to achieve the research objectives stated in (c)? **(1 marks)**

Question 3 (10 marks)

a. Briefly explain the following ethical values as they relate to the research process. **(6 marks)**

   i. Integrity
   ii. Confidentiality
   iii. Social responsibility

b. List and briefly explain two unethical practices that students and researchers should shun when conducting research. **(4 marks)**

SECTION B: NUTRITIONAL EPIDEMIOLOGY (50 MARKS)

Question 4 (10 marks)

In a prospective study of coffee consumption and Coronary Heart Disease, intake of 6 or more cups of coffee per day was associated with Relative Risk (RR) of 1.55 (95% CI, 1.12 to 1.9). Stratifying the data by smoking the results were as follows: smokers RR=1.3 (95% CI, 0.52 to 1.5) and Non-smokers RR 0.75 (95% CI, 0.30 to 1.12).

a) Interpret both the stratified and un-stratified results of the above study **(6 marks)**

b) Describe the effect of smoking on the results **(4 marks)**

Question 5 (10 marks)

a. Results from the Zambia STEPS Survey (2017) conducted by WHO and Ministry of Health indicates that 10% of adults aged 18-69 are not physically active (Having < 150 minutes of moderate-intensity activity per week, or equivalent). The STEPS results also demonstrate an increase in overweight and obesity in the same age group. Describe reverse causality using the STEPS results above. **(4 marks)**

b. Differentiate the following terms, as used in Nutritional Epidemiology:

   i. Incidence and prevalence

   ii. Exposure and outcome

   iii. Random error and systematic error **(6 marks)**

Question 6 (15 marks)

a) Using relevant examples briefly discuss consequences of failing to control for confounding in nutritional epidemiology. **(6 marks)**

b) Identify and briefly describe the main epidemiological study designs. **(9 marks)**

Question 7 (15 marks)

One of the most studied public health problems is cancer. In nutritional epidemiology, evidence has shown that eating processed meat increases the risk of developing colorectal cancer. Discuss the evidence is light of Bradford-Hill criteria for causation. **(15 marks)**

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE & NUTRITION

BSC HUMAN NUTRITION

AGN 5531 FOOD AND NUTRITION SECURITY

DATE: MONDAY 2ND JULY TIME: 14:00 – 17:00

DURATION: THREE (3) HOURS VENUE: OMNIA 2

INSTRUCTIONS TO CANDIDATES

1. THIS PAPER CARRIES 100 MARKS
2. DURATION OF THE EXAMINATION IS THREE (3) HOURS
3. ANSWER 1 AND **ANY** OTHER THREE (3) QUESTIONS
4. MARKS ALLOCATED FOR EACH QUESTION ARE INDICATED AGAINST IT

Question 1

a. What is a Food Balance Sheet? (FBS) (***1 mark***)

b. Discuss the provisions of the FBS (***3 marks***)

c. Outline the uses of FBS (***3 marks***)

d. Discuss the weaknesses of the FBS (***5 marks***)

e. What key messages can be derived from FBS (***2 marks***)

f. Show the basic equations used in FBS calculations (***3 marks***)

g. Outline and discuss at least six (6) key indicators used in the FAO-led food insecurity and vulnerability information and mapping systems (FIVIMS) (***10 marks***)

Question 2

a. Outline the overlapping determinants of nutrition security (***5 marks***)

b. For each determinant identified, briefly discus the indicator requirements (***10 marks***)

c. What key questions need to be answered with respect to food security and/or food insecurity? In each case identified, show relevance of the question. (***10 marks***)

Question 3

a. Provide a clear expose of the advantages and disadvantages of using the anthropometric measurements in providing food security data (***10 marks***)

b. In your own view, what other methods would you use to draw reliable conclusions with regard to the food insecurity situation of a given area (***10 marks***)

c. Indicate the reliable indicators that would apply in each case (***5 marks***)

Question 4

As a nutrition specialist, which policies would you apply to address broad based nutrition deficiency problems at national level?. Give reasons for your selection (***25 marks***)

Question 4

Using a specific and well outlined example, discuss the use of the "***value chain approach***" to address food and nutrition insecurity situation of a given area in Zambia (***25 Marks***)

Question 5

a. Food insecurity in a household can be seen as a combination of two (2) distinct problems; i.e. inability to ***acquire*** food and inability to ***utilize*** the food. Explain, using specific examples what each of these term imply (***5 marks***)
b. Discuss how women's empowerment programmes can impact positively to improve household food security (**20 marks**)

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE
AGS 2110 –FUNDAMENTALS OF SOIL SCIENCE

DEFERRED EXAMINATION 2019/2020 ACADEMIC YEAR

INSTRUCTIONS: Answer All Questions

TIME: 1.5 HOURS Marks: 100

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1. Define the following terms: (15 marks)
   a. Soil parent material
   b. Macronutrient
   c. Bt horizon
   d. Chemical weathering
   e. Matric potential
   f. Permanent wilting point

2. Indicate whether the following statements are: (i) True or (ii) False. (30 marks)

   a. Sandy soils generally hold more water than clay soils

   b. Granite is a volcanic rock

   c. Iron is one of the plant nutrients that is abundant in the earth's crust.

   d. Soils classified at the Great group level in Soil Taxonomy have greater similarities than soils classified at the Order level

   e. A soil with a colour code of 7.5YR 5/4 is redder and darker than one with colour code 10YR4/4.

   f. A soil at field capacity is unsaturated with respect to the soil moisture content.

   g. The fine earth fraction of the soil consists of soil particles with diameters of less 2000 μm.

   h. Soil colloids are large solid particles exhibit have a negative charge and high particle density.

   i. The value of the volumetric moisture content of mineral soils is usually larger than the value of its gravimetric moisture content.

   j. More energy is required to extract water from pores with a diameter of 40μm than to obtain pure water from a 0.05 molal solution of Na_2SO_4 at 20 °C.

k. A cubic metre of soil with a dry bulk density of 1.45g/cm^3 and a gravimetric moisture content of 6 % soil contains more than 50 litres of water and more than 1 metric tonne (1000 kg) of solid particles.

l. A 15 cm layer of soil covering an area of 40 m x 20 m that has a porosity of 45 % and a degree of saturation of 20 % will contain more than 80, 000 litres of air.

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

a. List any 3 types of aggregated soil structure and describe their shapes. (6 marks)

b. Soil forming processes are grouped into four major classes, list and define these four classes (6 marks)

c. In soil taxonomy the soils of the world are grouped into 12 Orders. Name any 3 soil orders that are not found in Zambia and describe their major characteristics (6 marks)

d. There are 13 nutrients that plants obtained from the soil. List any six plant nutrients, 3 of which should be macronutrients and 3 of which should be micronutrients and indicate which of them are macronutrients or micronutrients (6 marks).

e. List and describe the three mechanisms by which plant nutrient in the soil reach the surfaces of plant roots. (6 marks)

4. A 20 cm thick Ap horizon has the following properties.

θg	ρs	ρb	P	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	Al^{3+}	H^{+}	Total N	Org C
%	g.cm^{-3}	g.cm^{-3}	mg/kg	cmol/kg						%	%
4.55	2.59	1.32	6.3	5.17	1.00	0.08	0.12	0.06	0.14	0.05	0.68

Answer the following questions: (25 marks)

a. Calculate the volumetric moisture content of the soil in percent. (4 marks)
b. What is the porosity of this soil in percent ? (3 marks)
c. Express the moisture content of this soil in mm H_2O/cm soil. (3 marks)
d. What is the ECEC of this soil? (5 marks)
e. What is the base saturation of the soil? (2.5 marks)
f. How many litres of air are present in 1 ha of this soil layer? (7.5 marks)

Some useful data: R= 8.3145 J.mol^{-1}.k^{-1}, k = 273.15 + ° C, 1 ha = 10^4 m^2

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE
AGS 4210 -SOIL MINERALOGY AND CHEMISTRY

DEFERRED EXAMINATION 2019/2020 ACADEMIC YEAR

INSTRUCTIONS: **Answer All Questions**

TIME: 1.5 HOURS Marks: 100

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1. Define the following terms: (12 marks)
   a. Variable charge
   b. Crystal habit
   c. Gravel
   d. Destructive interference
   e. Trioctahedral 2:1 layer silicate
   f. Plane polarized light

2. Indicate whether the following statements are True (T) or False (F): (12 marks)
   a. One metric tonne of an evaporite deposit containing 80 % gypsum contains more than 120 kg of sulfur.
   b. Kaolinite is a 1:1 layer silicate mineral without permanent charge
   c. In Zambia , sulfate and carbonate minerals are more likely to be found in soils of Agro-ecological region I than in soils of Agro-ecological region III
   d. In the crystal structure of calcite the largest ion is O^{2-} while the smallest ion is C^{4+}.
   e. Smectite is more likely to be found in the clay fraction of Oxisols than in the clay fraction of Vertisols.
   f. A light ray with wavelength of 590 nm travelling through a 30μm crystal of quartz which has nω=1.544 and nε =1.553 will experience destructive interference.
   g. Granite is a plutonic rock.

3. A water sample from a shallow well in Sinazongwe has an ionic strength of 0.016, 0.658 mM Ca^{2+}, 8.315 mM HCO_3^- and 0.658 mM SO_4^{-2} at 25 ° C. Answer the following: (21 marks):

   a. Calculate the activity coefficients of Ca^{2+}, HCO_3^- and SO_4^{-2} in this water sample. (7.5 marks)
   b. What is the mean activity coefficient of $CaHCO_3^+$ in this solution? (3.5 marks)

   c. Given that the solubility product of gypsum Ksp = $10^{-4.58,}$ would you expect gypsum to dissolve in the water sample from Sinazongwe at 25 °C? Show calculations to support your answer. (10 marks)

4. Calcite ($CaCO_3$) is in common carbonate mineral found in soils. Its crystallographic properties are: $n\omega$=1.658, $n\varepsilon$ =1.486, a=4.989, b=4.989, c=17.062, d= 4.989. Answer the following questions (10 marks).
    a. To which crystal system/s do you expect calcite to belong? Give reasons to support your answer? (2.5 marks)
    b. Does calcite polarize light? Give reason to support your answer? (2.5 marks)
    c. What is the birefringence of calcite? (2.5 marks)
    d. In which of major agro-ecological region of Zambia would you expect calcite to be a common mineral in soils. Give reasons to support your answer. (2.5 marks)

5. Soil chemical reactions are basically an electrostatic interaction between surface charge on colloids and ions in solution, involving attraction, repulsion, exchange, transfers of electrons and ions between these two phases. Answer the following questions: (18 marks)
    a. List 3 major soil colloids and describe 2 fundamental characteristics of colloids in general (5 marks)
    b. Explain the basis for measuring soil reaction (pH) in a dilute 0.01 M $CaCl_2$ rather than in pure water (5 marks)
    c. List five functional groups on humic colloids that are the site of charge development, and demonstrate how surface charge develops on one of sites. (8 marks)

6. Ion adsorption is mathematically described by two models, the Freundlich for solid-liquid and the Langmuir model for solid-gas systems. Answer the following: (12 marks)

    a. When is the Langmuir equation applicable to soil-solution systems? (6 marks)

    b. Clearly distinguish Freundlich from Langmuir adsorption mechanisms. (6 marks)

7. The availability of nutrients to plants in soils is related to the activity of bioavailable forms in the nutrients present in the soil solution. Answer the following question: (15 marks)

    Given that ferrihydrite ($Fe(OH)_3$) with pK_{sp} = 37.5 is the mineral that controls the activity of Fe in soil, show that a citrus plant requiring a minimum activity of 10^{-10} M of Fe^{2+} would exhibit iron deficiency symptoms when grown on a calcareous soil with pH of 8.5. (15 marks)

Useful data: Molar masses Ca=40g, S= 32g, O=16g, H=1 g

END OF EXAMINATIONS

THE UNIVERSITY OF ZAMBIA

MID-YEAR EXAMINATIONS
JULY 2018

AGS 4221
SOIL AND PLANT ANALYSIS

TIME: 3 HOURS MARKS: 100
INSTRUCTIONS: **ANSWER ALL QUESTIONS**

1. Sampling of soils is the stage that precedes the laboratory analyses of soils. It is a stage that is often not given critical attention. Answer the following: **(20 marks)**
   a. List and define any two common methods of collecting soil samples from the field. (4 marks)
   b. Briefly indicate the advantages and disadvantages of submitting single composite soil samples laboratory for analysis. (3 marks)

   c. The site of a former car battery plant believed to be contaminated with Pb, has a large area with soils that have a mean Pb concentration of 567 mg/kg with a standard deviation of 94 mg/kg soil.

      i. What is the degree of variability of Pb in the soils at this site? Show the calculations to support your answer. (3 marks)

      ii. Would you consider a soil sample with a Pb concentration of 980 mg/kg to be an outlier for the above site, if the Pb concentration is considered to be normally distributed? Show the calculations to support your answer. (5 marks)

      iii. How much would it cost to estimate the mean concentration of Pb at this site with 95 % confidence, with an allowable error of 2.5 % of the mean (567 mg/kg) if the lab analysis for Pb costs K150 per sample? Note $Z_{0.025}=1.96$ (5 marks)

2. Salt affected soils are often problematic when used for crop production. Answer the following questions: **(20 marks)**
   a. Indicate the two main problems associated with salt affected soils and describe how they adversely affect the productivity of soils? (5 marks)

   b. An NGO wants to assist a poor farming community located near a mine in Agro-Ecological region I to embark on vegetable production to improve household income and nutrition using water pumped from the mine for irrigation. Results of laboratory analyses of the major cations and anions in the water from the Mine are presented in Table 1 below.

Table 1. Concentrations of cations and anions in the mine water in meq/L.

Ca^{2+}	K^+	Mg^{2+}	Na^+	HCO_3^-	CO_3^{2-}	Cl^-	SO_4^{2-}
1.98	0.25	1.14	1.67	4.14	0.05	0.09	0.76

Answer the following:

i. Calculate the values of the Electrical Conductivity (EC in mS/cm), Sodium Adsorption Ratio (SAR), and Residual Sodium Carbonate (RSC) for the water sample. (9 marks)

ii. Using Table 2 below determine the Salinity, Sodicity and Alkalinity hazards of the water and give the overall suitability rating of the water for use in irrigation. (4 marks)

iii. What problem/s would you anticipate in fields irrigated with the above water if appropriate soil management practices are not used? (2 marks)

Table 2. Classification of water quality based on salinity, sodicity and alkalinity

Water Quality Hazard	Rating of water quality hazard			
	Low	Medium	High	Very High
Salinity EC (mS/cm)	<0.25	0.25 - <0.75	0.75 - <2.25	≥ 2.25
Sodicity (SAR meq/L.$(meq/L)^{-0.5}$)	< 1.25	1.25 – < 2.50	≥ 2.50	
Alkalinity (RSC (meq/L))	< 7.0	7.0 - < 13.0	13 - < 20	≥ 20

3. To determine the neutralising value of granular $Ca(OH)_2$, 1 g of the material was dissolved in 25 ml of 1 N standard hydrochloric acid and then titrated the mixture with 1 N sodium hydroxide. **(20 marks)**

a. Write balanced chemical equations of all the reactions involved in the above test. (4 marks)

b. Given that 15 ml of sodium hydroxide were used in the titration, calculate the amount of acid neutralised by of $Ca(OH)_2$. (4 marks)

c. Given that 1 g of $CaCO_3$ can neutralise 20 meq of H^+, calculate the neutralising value (%) of $Ca(OH)_2$. (4 marks)

d. Using your calculation in (c.) above, state whether the material in question is more effective than pure calcium carbonate. (2 marks)

e. Write brief notes on any three factors commonly used to evaluate the suitability of a liming material. (6 marks)

4. Answer the following questions **(15 marks)**

   a. To determine K in soil, 5 g of soil is equilibrated in 100 ml of 1M ammonium acetate for 2 hours, then filtered. The concentration of K in 10 ml of the filtrate is 1.2 mg/L.

      i. Express the amount of K in mg K/kg soil. (2 marks)

      ii. Would this soil meet the nutrient requirements for a crop that needs 65 kg K per hectare, if you assume a soil depth of 20 cm and a bulk density of 1.4 g/cm^3? Show your calculation to support your answer. (7 marks)

   a. Phosphorus is the most immobile nutrient among the major plant nutrients. In soils, it can occur in organic or inorganic forms.

      i. Describe (very) briefly how organic P in a soil sample is determined. (3 marks)

      ii. What is the main limitation of the Olsen's method (in the determination soil P) with regards to the use of $NaHCO_3$ solution as an extractant and how can you remedy this? (3 marks)

5. To determine the organic matter content of a soil by the Walkley and Black method, 1 g of soil was weighed in an Erlenmeyer flask. Then, 10 ml of 0.17 M $K_2Cr_2O_7$ was added, followed by 20 ml of concentrated H_2SO_4 and mixed gently. After 30 minutes, 150 ml of distilled water and 10 ml of concentrated H_3PO_4 acid were added. About 1 ml of indicator solution was added to the mixture before titrating with $FeSO_4$. A blank (with no soil) was treated similarly. Given that 9.95 ml of $FeSO_4$ was consumed during the titration of the blank and 4.95 ml of $FeSO_4$ was used for the soil sample, answer the following: **(25 marks)**

   a. Write balanced redox reactions during;
      i. The decomposition stage, giving a total redox for this stage. (2.5 marks)
      ii. The titration stage, giving a total redox for this stage. (2.5 marks)
   b. Calculate the exact concentration of $FeSO_4$ solution used during the titration. (4 marks)
   c. Calculate the soil organic carbon (%) using the balanced equations in 5a, assuming that Walkley and Black method only oxidizes 75% of total organic carbon. (6.5 marks)
   d. Estimate the organic matter content of this soil sample if; organic matter consists of 58% carbon. (2.5 marks)
   e. Suppose organic carbon of the same soil was determined using Loss on Ignition method. The dry weights (DW) of the soil were: $DW_{105°C}$ = 121.9 g, and $DW_{550°C}$ =119.2 g. Calculate the organic carbon content of this soil. (3 marks)
   f. Compare the value of organic carbon determined in 5c and 5e. Which value of organic carbon is larger, and discuss briefly why? (4 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS-JULY 2018

AGS 5121

SOIL GENESIS AND CLASSIFICATION

TIME: **THREE HOURS**

TOTAL MARKS: **100**

INSTRUCTIONS: **ANSWER ALL QUESTIONS**

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1. Give a comparative analysis of the structure and application of the USDA Soil Taxonomy and the FAO World Resource Base for classification of soils. 10 marks

2. Compare and contrast the properties of the following soil types:
   a. Chernozems, Kasternozems and Phaeozems 5 marks
   b. Leptosols and Regosols 5 marks
   c. Ferralsols and Acrisols 5 marks
   d. Gleysols and Stagnosols 5 marks
   e. Lixisols and Luvisols 5 marks

3. Explain the main soil forming processes involved in the formation of the following soils:
   a. Histosols 2 marks
   b. Podzols 2 marks
   c. Fluvisols 2 marks
   d. Solonetz 2 marks
   e. Solonchaks 2 marks

4. a. Using a diagram explain the concept of 'soil catena' 5 marks

   b. Explain the soil forming processes active in the soil catena 5 marks

5. You have been invited to an international conference to give a presentation of the soils of Region III of Zambia. Prepare your presentation by highlighting the following:

   a. Climatic characteristics of Region III 4 marks

   b. Major soil forming processes active in Region III 4 marks

   c. Major soil types of Region III and their chemical and physical characteristics 8 marks

   d. Remedial measures for sustaining land productivity 4 marks

6. Two (2) soil types have been classified as follows:

   i. Fine, Mixed, Isohyperthermic, Typic Rhodustult

   ii. Loamy, Kaolinitic, thermic Kanhaplic Rhodustalf

      a. Give a comprehensive description of the properties of these soils 10 marks

      b. Give a comprehensive description of the potential and limitations of each soil type for arable cropping and provide management recommendations for sustaining land productivity 10 marks

7. Give at least seven (7) reasons why we classify soils 5 marks

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY DEFFERED EXAMINATIONS – 2019/2020

AGS 5121

SOIL GENESIS AND CLASSIFCATION

TIME: **ONE AND HALF HOURS**

INSTRUCTIONS: **ANSWER ALL QUESTIONS**

TOTAL MARKS: **70**

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1. a. Present at least five (5) reasons why we classify soils (5 Marks)

   b. Explain with examples the application of soil classification in soil research and agrotechnology transfer (5 marks)

2. What are the major soil forming processes involved in the formation of the following diagnostic horizons:

   a. Mollic epipedon (2 marks)

   b. Anthropic epipedon (2 marks)

   c. Spodic horizon (2 marks)

   d. Argillic horizon (2 marks)

   e. Oxic horizon (2 marks)

3. Present the major characteristics of the following soils and suggest a package of remedial measures for arable cropping for each one of them

   a. Natrustalf (2 marks)

   b. Duriaquods (2 marks)

   c. Plinthudults (2 marks)

   d. Calciusterts (2 marks)

e. Eutrustox (2 marks)

4. You have been invited to an international conference to give a presentation of the soils of Region III of Zambia. Prepare your presentation by highlighting the following:
   a. Climatic characteristics of Region III 5 marks
   b. Major soil forming processes active in Region III 5 marks
   c. Major soil types of Region III and their chemical and physical characteristics 5 marks
   d. Remedial measures for sustaining land productivity 5 marks

5. Explain the main soil forming processes involved in causing the following soil morphological features:
   a. Clay films around pores and peds in the subsoil (3 marks)
   b. Fe and Mn mottles in the subsoil (2 marks)
   c. Grey colours in the subsoil (2 marks)
   d. Cracks and gilgai micro-relief on the soil surface (3 marks)

6. A soil has been classified in Soil Taxonomy (2014) as Fine, Mixed, Isohyperthermic, Typic Rhodustult, give its chemical and physical and environmental properties (10 marks)

END OF EXAMINATION

The University of Zambia

School of Agricultural Sciences

Mid Year Final examinations: July, 2018

AGS 5131: Soil Survey and GIS Techniques

Time: 3 hours

Total Marks: 100

Instructions: Answer all the questions

Question 1: Grid and free survey are the two methods commonly used in soil survey.

a) What is the difference between the two methods of survey? **(5 marks)**
b) What would be the most appropriate map units to use under each of the methods stated above? **(2 marks)**
c) Assume that you have been contracted by a farmer to survey his 945 hectare farm. What method of soil survey would you use? (Explain why) **(5 marks)**
d) How would you determine the observation density for the 945 hectare farm stated above **(4 marks)**
e) At what scale would you map this 945 hectare farm? **(4 marks)**

Question 2: Assume that a soil unit has been defined on the basis of clay content. The sand content in a certain map unit is measured at 6 randomly selected points as shown below:

Point 1----------16 %

Point 2----------13%

Point 3----------25%

Point 4----------30%

Point 5----------9%

Point 6----------8%

a) With specific examples, explain what you understand by a soil map unit **(5 marks)**
b) What is your comment on the accuracy of this mapping given that the maximum soil variability should not exceed 10%? **(5 marks)**
c) Explain what soil variability is and its significance in soil mapping **(5 marks)**
d) What are the major causes of soil variability within mapping units? **(5 marks)**

Question 3: Some of the main phases in field surveys include the mapping and interpretation phases.

a) What are the main components of the mapping phase? **(8 marks)**
b) Explain the significance of the interpretation phase in soil survey? **(2 marks)**

Question 4:

List at three (3) sources of primary data and five (5) sources of secondary for use in a GIS designed for land management sustainable land and environment management. (8 marks)

a. What factors will influence your choice of a map projection? **(5 marks)**

b. What is a datum and how does it differ from a map projection? **(5 marks)**

Question 5: Explain with suitable examples using soil data and related fields what is meant by each of the following:

a. Compound buffering **(5 marks)**
b. Nested buffers **(5 marks)**
c. Simple buffers **(5 marks)**

Question 6: The soil survey report is an important stage in soil mapping.

a) List with brief notes the main components of a soil survey report. **(7 marks)**

b) Why is a section on land capability often included in a soil survey report? **(10 marks)**

END OF EXAMINATION

UNIVERSITY OF ZAMBIA

FIRST HALF EXAMINATIONS –JULY 2018

AGS 5411: SOIL MICROBIOLOGY

Time: Three (3) Hours **Marks: 100**

Instructions: Answer all Questions

1) The decomposition of organic matter is largely a microbial process that is affected by environmental factors significant for microbial growth.**[20 marks]**
   a. Compare and contrast aerobic and anaerobic decomposition. (8 marks)
   b. Discuss any three environmental factors that affect the rate of organic matter decomposition. (12 marks)
2) Mathematical models that predict the growth of bacteria such as *Salmonella* are useful tools in bacteriology. **[20 marks]**
   a. Design an experiment that can be used to monitor bacterial population growth.(4 minutes)
   b. Given that *Salmonella* sp has a generation time of 30 minutes, calculate the number of generations for the population to increase a hundred times from an initial population of 10^3 cfu/ml assuming that the bacterium in question replicates by binary fission. (4 marks)
   c. Illustrate and write brief notes on all the phases of a typical growth curve. (12 marks)

3) Amending soils with inorganic fertilizers, organic matter and lime has varied effects on several microbial processes in the soil. Explain in detail the direct and indirect effects of the following land management practices on denitrification, nitrification **and / or** symbiotic nitrogen fixation **[30 marks]**:
   a. Addition of mineralizable organic matter **[6 marks]**
   b. Addition of ***Blue*** and/ or ***Black*** urea **[6 marks]**
   c. Addition of Single Super Phosphate (SSS) **[6 marks]**
   d. Inoculation of legume seed with highly infective but ineffective Rhizobia **[6 marks]**
   e. Addition of gypsum to the soil **[6 marks]**

4) Below is an excerpt from a paper on phosphate-solubilizing bacteria. Answer the following questions concerning this paper **[20 marks]**:
   a. What is the full citation of this paper? **[3 marks]**
   b. How would one cite this paper in-text? **[2 marks]**
   c. What is the objective of the paper? **[2 marks]**
   d. What is the mechanism of P solubilization? [**4 marks**]
   e. Apart from malic and oxalic acids, name three other organic acids typically produced by soil microorganisms that could have been used in this study? [**3 marks**]
   f. In this study, why was it important to determine **root morphology** and **soil pH** [**3 marks**]

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Research Article

Application of Potential Phosphate-Solubilizing Bacteria and Organic Acids on Phosphate Solubilization from Phosphat Rock in Aerobic Rice

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A study was conducted at Universiti Putra Malaysia to determine the effect of phosphate-solubilizing bacteria (PSB) and or acids (oxalic & malic) on phosphate (P) solubilization from phosphate rock (PR) and growth of aerobic rice. Four rates of organic acid (0, 10, 20, and 30 mM), and PSB strain (*Bacillus* sp.) were applied to aerobic rice. Total bacterial populations, an of P solubilization, P uptake, soil pH, and root morphology were determined. The results of the study showed significantly h solubilization in PSB with organic acid treatments. Among the two organic acids, oxalic acid was found more effective com to malic acid. Application of oxalic acid at 20 mM along with PSB16 significantly increased soluble soil P (28.39 mg kg^{-1}), p uptake (0.78 P pot^{-1}), and plant biomass (33.26 mg). Addition of organic acids with PSB and PR had no influence on soil pH d the planting period. A higher bacterial population was found in rhizosphere (8.78 $\log_{10}$ cfu g^{-1}) compared to the nonrhizos and endosphere regions. The application of organic acids along with PSB enhanced soluble P in the soil solution, improve growth, and increased plant biomass of aerobic rice seedlings without affecting soil pH.

5) Giving appropriate examples, explain how you would demonstrate the following microbial relationships under laboratory conditions **[10 marks]**:

   a. Commensalism **[5 marks]**
   b. Predation **[5 marks]**

-End-

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – NOVEMBER 2019/2020

AGS 5522

MANAGEMENT OF IRRIGATION AND DRAINAGE SYSTEMS

Time: One and a half (1.5) hours Total Marks: 70

Instructions: Answer **ALL** questions

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1. Lysimeters are based on the conservation of mass principle:

   $\Delta s = D_{rz}(\theta_f - \theta_i)$ = inflow – outflow;

   Several parameters are involved in the inflow-outflow relationship, these are the following: [DP, SFI, LI, LO, ET, P, I, GW, L and RO] **[20 Marks]**

   a. Describe the elements in the equation, $\Delta s = D_{rz}(\theta_f - \theta_i)$ **[5 Marks]**

   b. Write the correct relationship of inflow and outflows based on the parameters given above **[2 marks]**

   c. Give the description of each of these elements including the appropriate units **[10 Marks]**

   d. Write an equation for ET based on these parameters **[3 Marks]**

2. Environmental and socio-economic impacts of irrigation vary in magnitude and extent, from location to location. **[20 Marks]**

a. Indicate whether the following statements are **true or false;** **(Note:** For a correct answer = 2 marks, wrong answer = - 2 marks and 'I don't know' = 0 Marks**)**

i. Irrigation can result in reduced river flow. **[2 Marks]**

ii. The reduced downstream river flow may not cause conflicts. **[2 Marks]**

iii. Irrigation development can cause disappearance of ecologically and economically important wetlands and biodiversity. **[2 Marks]**

iv. Over-abstraction of shallow water wells for irrigation in highland areas results in saltwater intrusion.**[2 Marks]**

v. Land subsidence can occur in certain places due to increased irrigation using groundwater. **[2 Marks]**

b. Mention three (3) pollution problems associated with agriculture. **[6 marks]**

c. List four (4) water-borne diseases associated with stagnant irrigation water. **[4 Marks]**

3. A farmer looking to venture into production of irrigated tomatoes in the hot dry season has just had a borehole dug. The borehole report shows that the well yield is 4 l s^{-1}. A soil sample collected from a one (01) hectare field to be used for production of the crop was analysed in the laboratory and reviewed that the soil had a sandy loam texture, volumetric water content of 27.8 % at field capacity and 14.3 % at wilting point. Given that the average actual crop evapotranspiration is 7 mm day^{-1}, allowable depletion factor of available water of 0.53 and average crop rooting depth of 30 cm, answer the following; **[30 Marks]**

a. Calculate the readily available soil water to the crop. **[6 Marks]**

b. Hence, calculate the appropriate irrigation interval.**[3 Marks]**

c. If the farmer could only afford four (04) hours of power from a generator unit per day and wants to deploy a drip irrigation system in the field to irrigate by pumping water directly from the well;

   i. What would be the minimum discharge requirement of the water pump if the farmer is irrigating on a daily basis? **[4 Marks]**

   ii. What would be the minimum discharge requirement of the water pump if the farmer only supplied water at an interval you determined in (b) above? **[4 Marks]**

d. Is it possible for the well to supply the discharge requirement in (c_i) and (c_{ii})? If not, what irrigation management changes should be made? **[6 Marks]**

e. Assuming a drip lateral spacing of 1 m, emitter spacing of 0.3 m and uniform emitter discharge of 1 l hr^{-1}, how much time would it take from the start to the end of the irrigation;

   i. If irrigation is done on a daily basis? **[2 Marks]**

   ii. If irrigation is done after the interval you determined in (b) above? **[2 Marks]**

f. Which of the irrigation plans, either daily or after an interval determined in (b) above, would be the best. Explain why you think this would be the best plan. **[3 Marks]**

.....

END OF EXAMINATION