

**THE UNIVERSITY OF ZAMBIA**  
**SCHOOL OF AGRICULTURAL SCIENCE**  
**SUPPLEMENTARY EXAMS 2016/2017**

AGA	2110	ANATOMY AND PHYSIOLOGY OF FARM ANIMALS
AGA	3201	PRINCIPLES OF ANIMAL NUTRITION
AGA	3212	APPLIED ANIMAL NUTRITION
AGA	3335	PRINCIPLES OF ANIMAL SCIENCE
AGA	4532	PIG AND POULTRY PRODUCTION
AGA	5712	ANIMAL HEALTH
AGC	3121	CROP PRODUCTION
AGE	4142	AGRICULTURAL MARKETING AND PRICING
AGE	5241	PRINCIPLES OF FARM MANAGEMENT
AGE	5251	AGRICULTURAL PROJECT PLANNING AND APPRAISAL
AGE	5262	INTERMEDIATE FARM MANAGEMENT
AGF	3042	INSTRUMENTAL METHODS IN FOOD ANALYSIS (THEORY)
AGG	3811	RURAL SOCIOLOGY
AGN	3222	HUMAN NUTRITION
AGN	3232	PRINCIPLES OF DIETETICS
AGN	5531	FOOD AND NUTRITION SECURITY
AGS	2110	FUNDAMENTALS OF SOIL SCIENCE
AGS	3711	AGROCLIMATOLOGY
AGS	4232	SOIL FERTILITY AND AMENDMENTS

SCHOOL OF AGRICULTURAL SCIENCES  
DEPARTMENT OF ANIMAL SCIENCE

SUPPLEMENTARY EXAMINATION QUESTIONS - 2016/17 ACADEMIC YEAR

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

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

SECTION A

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER QUESTION FROM THIS SECTION

QUESTION ONE

- A. Briefly describe the following terms as used in anatomy and physiology of farm animals; [10]
- |  |                      |
|--|----------------------|
| i. Progranulocyte                          | iv. Corpus luteum    |
| ii. Physiological buffers                  | v. Graafian follicle |
| iii. Modified monogastric digestive system |                      |
- B. With regard to farm animals only;
- |  |     |
|--|-----|
| i. List the differences between digestive systems of poultry and other domestic animals. | [4] |
| ii. What are the names of functional cells of the respiratory system?                    | [2] |
| iii. Name two functions of the caecum.   | [2] |
| iv. What is the role of arrector pilli muscle?   | [2] |

QUESTION TWO

- With regard to reproduction in farm animals,
- |  |     |
|--|-----|
| i. What is the function of seminiferous tubules in male animals?             | [2] |
| ii. Briefly describe the three sections of the broad ligament.               | [3] |
| iii. What are the glands or organs considered accessory to male animals?     | [4] |
| iv. Use a clearly labelled diagram to show the parts of a Graafian follicle. | [8] |
| v. Name the sections of the epididymis.                                      | [3] |

QUESTION THREE

- With regard to the digestive system of farm animals,
- |   |     |
|---|-----|
| i. Use a well labelled diagram to show the main features of a monogastric digestive system. | [8] |
| ii. Briefly describe the segments and function of the ruminant stomach                      | [8] |
| iii. What is function of the jejunum in ruminant animals?                                   | [3] |
| iv. What is the role of the abomasum?   | [1] |

With regard to farm animals,

- i. Name four functions ascribed to integumentary system. [4]
- ii. In the event of a change in pH, describe the sequence in which regulatory mechanisms are invoked in an attempt to restore pH to normal. [7]
- iii. What is the role of the pampiniform plexus in male animals? [3]
- iv. Briefly explain the function and product of melanocytes. [4]
- v. What is the function of keratinocytes? [2]

## **SECTION B**

**CHOOSE ANY TWO QUESTIONS FROM THIS SECTION AND WRITE THE ANSWERS IN A SEPARATE ANSWER BOOK. EACH QUESTION IS WORTH TWENTY (20) MARKS.**

### **QUESTION ONE**

The biological membrane present in both eukaryotic and prokaryotic cells is also called as cell membrane. Explain why the cell membrane is of great significance to the animal cell.

### **QUESTION TWO**

Briefly describe each of the main functions of epithelial tissue and the area or organ where these functions occur.

### **QUESTION THREE**

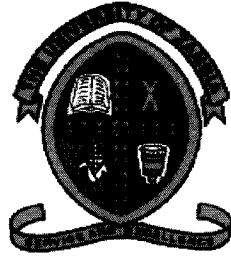
Write short notes on different types of muscle tissues and give examples of where they are found in the body.

### **QUESTION FOUR**

With the aid of a well labelled diagrams, write short notes on the following;

- i. The cell body
- ii. Dendrites
- iii. Axon and
- iv. Myelin sheath

**END OF EXAMINATION**



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

2016 ACADEMIC YEAR SUPPLEMENTARY EXAMINATIONS

AGA 3201: PRINCIPLES OF ANIMAL NUTRITION

DATE: 2<sup>nd</sup> November 2017 (09:00 hrs): Time Allowed Three (3) Hours

**INSTRUCTIONS TO CANDIDATES:**

Answer any **five (5)** questions using separate answer sheets for **Sections A and B**. All questions carry 20 equal marks.

**SECTION A**

1. A). What are the main sources of proteins for feeding non-ruminants (4 Marks)?  
 B). How are these proteins digested and absorbed in the Gastro Intestinal Tract (GIT) of non-ruminants (12 Marks)?  
 C). Why are some of the end products of protein digestion termed as essential while others are said to be non-essential (4 Marks)?
2. A). Explain the difference between storage and structural carbohydrates and where can you find the different types of these carbohydrates in nature (8 Marks)?  
 B). Name at least two disorders that are associated with improper metabolism of carbohydrates in farm animals and explain how each disorder is brought about and suggest measures that may have to be taken in order to address the condition (12 Marks)?
3. A). Name and explain the importance of at least two accessory organs that are associated with the digestion of feeds in farm animals. List other key functions for each of the mentioned accessory organs (10 marks)?  
 B). Name key digestive structures that are found in the mouth of farm animals and explain how each structure facilitates the digestion of feeds in the lower GIT (10 Marks)?
4. A). What are the main processing methods used in preparing feeds for non-ruminants and how is each method important in ensuring quality of animal feeds (12 Marks)?

B). What is the difference between Metabolizable energy and Net energy and how does the net energy for production differ from that for maintenance (8 marks)?

### **SECTION B**

5). A). What are anti-nutritional factors and can you name and explain the source and mode of action of at least four (04) common endogenous anti-nutritional factors found in animal feedstuffs and how can the effects of these anti-nutritional factors be minimized to improve feed utilization (14 Marks).

B). Explain why some Anti-Nutritional Factors may be toxic to non-ruminants and not to ruminant animals and what are the advantages of pre -gastric fermentation when compared to post-gastric fermentation (6 Marks)?

6. A). Mention two (02) sources of crude protein and two sources of Non Protein Nitrogen (NPN) used as sources of protein for feeding ruminants (4 marks)?

B). Describe how the sources of NPN mentioned above are metabolised in the rumen and utilised in the ruminant animal (8 Marks).

C). Write short notes on urea toxicity and explain why feeding high value protein sources to ruminants is sometimes considered to be wasteful (8 Marks)?



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DEPARTMENT OF ANIMAL SCIENCE**

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**2016 ACADEMIC YEAR SUPPLEMENTARY EXAMINATIONS**

**COURSE AGA 3212: APPLIED ANIMAL NUTRITION**

**DATE: 3<sup>rd</sup> NOVEMBER, 2017 (09:00 Hours)**

**TIME ALLOWED: THREE (3) HOURS**

**INSTRUCTIONS TO CANDIDATES:**

- i. Answer any five (5) questions.**
  - ii. Write the answers for each Section in separate answer books and mark books appropriately as Section A, B or C.**
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**SECTION A**

**QUESTION 1**

- A. Why is it important to monitor feed intake in farm animals and what steps do you need to undertake in order to maximize feed intake? **(8 Marks)**
- B. Explain in detail the steps you require to consider in coming up with a list of feed ingredients you need in formulating diets for the animals that you keep on the farm? **(12 Marks)**

**QUESTION 2**

- A. Assume you have a herd of beef cattle consisting of one bull, 8 cows, 7 two-year old heifers, 6 yearling steers and 5 calves. You are required to plan for a 5 - months dry season feeding period. Your expected fodder production from your crop production activities is as tabulated in Table 1 and include Maize Stover, Soy Beans Straw and hay from Siratro, Star grass and Lucerne. If your animals are expected to consume 12kg dry matter per day per Livestock Unit (LU) and consider that a bull is equivalent to 1.2 LU, a cow 1.0 LU, a 2-year old heifer/steer 0.7 LU, 1-year old heifer/steer 0.5 LU and calves under 1 year are 0.3 LU. How long is this fodder expected to last on the farm? Assuming you have to buy extra hay to get the animals to the end of the dry season; how much hay on as fed basis are you supposed to buy for the remaining period? Assume that available hay on the market contains 55% Dry Matter. **(8 Marks)**

Table 1: Expected fodder production from on-farm crop production operations

Crop	Hectares	Type of fodder	Expected Yield	DM Content
Maize	2.0	Stover	5 tons/ha	80%
Siratiro	1.5	Hay	2.5 tons/ha	75%
Soy bean Straw	2.0	Straw	3 tons/ha	73%
Star grass	2.5	Hay	5 tons/ha	70%
Lucerne	1.0	Hay	2.5 tons/ha	65%

- B. Assume you have a 480kg dairy cow that is producing milk with 4.5% butter fat content and the animal depends on a 3:1 grass and legume hay mixture. The grass is said to have 60% Dry matter and contains 600g TDN and 70g digestible crude protein (dCP) per kg dry matter. On the other hand, the legume is said to have 65% dry matter and contains 700g TDN and 110g (dCP) per kg DM. If the cow consumes 2.5% of its body weight as DM intake, how much grass and legume 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 grass and legume hays when expressed on as fed basis? How much milk per day is this animal expected to produce by consuming the calculated amounts of grass and legume considering the maintenance and milk requirements are as tabulated in Table 2?

(12 Marks)

Table 2: 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

## SECTION B

### QUESTION 3

- A. Hay is arguably the most preferred mode of conserving forages. However, for Hay to be superior in quality, one must consider four factors. What are these four factors? Briefly describe these factors. (10 marks)
- B. The principle property of fats and/or oils as a nutrient source is energy supply. However, there are other roles that these materials play apart from energy supply. What are the other benefits of using fats and/or oils as feed ingredients? What is the major disadvantage of their use? (10 marks)

#### QUESTION 4

A. Some of the commonly used feed ingredients are known to contain factors that are detrimental to good nutrition. Identify the factors/components associated with the ingredients listed below explaining how and where they exert their detrimental effects as well as measures that can be taken to counteract or avoid their effects.

(10 marks)

- i. Soy bean meal
- ii. Sunflower meal

B. Briefly:

- i. State four (4) advantages of molasses use in livestock feeding. (4 marks)
- ii. Write short notes on problems associated with the use of poultry litter in livestock feeding. (3 marks)
- iii. Write short notes on how to improve the feeding value of crop residues. (3 marks)

#### SECTION C

#### QUESTION 5

A. Using the Pearson square method, formulate a 100 Kg quail starter ration with 24% CP using the following ingredients: maize grain, soybean meal, wheat bran, 1kg mineral premix (0% CP) and fish meal. The feed should not have more than 6% wheat bran and 3% fish meal (i.e., maximum level of inclusion). The nutrient composition of the mentioned ingredients is as shown in the table below; (15 Marks)

Ingredient	CP %	Ca%	P%
Maize grain	9.2	0.05	0.27
Soybean meal	41.7	0.13	1.13
Wheat bran	14.7	0.26	0.61
Fish meal	43.1	2.19	1.67
Mineral premix	0	0	0

B. You are informed that the quail chicks to be fed this feed require 1% Ca and 0.65% P. Does this feed contain adequate Ca and P to meet the quail's requirement?

(5 Marks)



### QUESTION 6

As a consultant, you have been asked to formulate a 100kg pig finisher concentrate to be mixed with 300Kg of maize to make a complete diet. The ingredients available are Soybean meal, dicalcium phosphate (DCP), Limestone flour, salt, Vitamin premix, Trace minerals premix, and the composition of these ingredients is as shown in the Table below;

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
Salt			
Vitamin premix			
Trace mineral premix			

- A. What should be the concentration of CP, Ca, P, Salt, trace minerals and Vitamin premix in the concentrate so that when 400kg of maize meal is added to the concentrate, the complete ration contains 14%CP, 0.5% Ca, 0.4%P, 0.5% Salt, 0.5%, 0.1%TM and 1.0% vitamin premix. **(6 Marks)**
- B. Determine the proportions (Kg) of each of the listed ingredients to be incorporated in the concentrate. **(14 Marks)**



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**2016/2017 ACADEMIC YEAR SUPPLEMENTARY EXAMINATIONS**

**COURSE AGA 3335: PRINCIPLES OF ANIMAL SCIENCE**

**DATE OF EXAMINATION: 2<sup>nd</sup> NOVEMBER, 2017 (09:00 Hours)**

**TIME ALLOWED: THREE (3) HOURS**

**INSTRUCTIONS TO CANDIDATES:**

- A. Answer any five (5) questions.**
  - B. Marks for each question are as shown.**
  - C. Write the answers for each Section in separate answer books and mark books appropriately as Section A, B or C.**
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**SECTION A**

**QUESTION 1**

- A. Dead and culled birds can be a source of infection in poultry houses. They should be collected and disposed of daily. Briefly describe two methods of bird disposal. (4 marks)**
- B. Write brief notes on the following:**
  - i. Organic agriculture/production (3 marks)**
  - ii. Coccidiosis (3 marks)**
  - iii. Needle teeth clipping (3 marks)**
  - iv. PSE meat (3 marks)**
- C. What are the advantages and disadvantages of poultry rearing? (4 marks)**

**QUESTION 2**

- A. Farrowing is an important part of pig production. What is farrowing and what are the signs or indications of farrowing? What are the factors that cause delays in the farrowing process? (10 marks)**
- B. Briefly:**
  - i. State the advantages of feeding pellets (3 marks)**

- ii. Describe Landrace breed of pigs (2 marks)
  - iii. Describe castration in pigs (2 marks)
- C. What is biosecurity? Give two main objectives of biosecurity. (3 marks)

## SECTION B

### QUESTION 3

- A. With at least five points, explain why you would recommend dairy farming in Zambia? (10 Marks)
- B. Mention any two common dairy breeds in Zambia that you are familiar with, and describe at least two distinguishing characteristics that easily identify them. (5 Marks)
- C. State at least five advantages of using artificial insemination in dairy farming. (5 Marks)

### QUESTION 4

- A. Write short notes on the importance of adhering to the following management routines in beef farming;
- i. Ensuring that newly-born calves have access to colostrum milk within the first 24-36 hrs of their lives. (6 Marks)
  - ii. Ensuring that calves that are less than 3 months old are not allowed to be dipped (2 Marks)
- B. List four advantages of hand mating when compared to pasture mating? (4 Marks)
- C. State four reasons why a heifer should not be serviced on its first observed heat. (8 Marks)

## SECTION C

### QUESTION 5

With regard to domestic animals;

- A. Briefly explain how an animal losses heat to the environment. (4 marks)
- B. Describe the types of respiration. (4 marks)
- C. State the types of uteri found in domestic animals. (4 marks)
- D. Using a well labelled diagram, show the main features of a modified mono-gastric digestive system. (8 marks)

### QUESTION 6

With regard to domestic animals;

- A. State the types and functions of cells found in the blood of animals. (6 marks)
- B. Explain what thermoneutral zone (TNZ) is. (2 marks)
- C. Using examples, state the hormones produced by the pituitary gland. (5 marks)
- D. Using a well labelled diagram, show the main features of a female reproductive system. (7 marks)



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**2016/2017 ACADEMIC YEAR SECOND SEMESTER SUPPLEMENTARY EXAMINATIONS**

**COURSE AGA 4532:                      PIG AND POULTRY PRODUCTION**

**DATE OF EXAMINATION: 3<sup>RD</sup> NOVEMBER, 2017**

**DURATION:                                      THREE (3) HOURS**

**INSTRUCTIONS TO CANDIDATES:**

- i.      Answer all questions.**
  - ii.     Marks for each question are as shown.**
  - iii.    Write the answers for each Section in separate answer books and mark books appropriately as Section A B or C.**
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**SECTION A              BROILER, LAYER AND QUAIL PRODUCTION**

**Q1.** Quail production is on the increase in Zambia. However, there are limited sources of stock available for those interested in engaging in the enterprise. As the officer responsible for new livestock production developments in the Ministry of Livestock and Fisheries you have been given the task of setting up a hatchery to produce 10,000 quail chicks per day.

- i.** Describe the hatchery that you will set up to ensure maximum output of healthy chicks. Indicate the relevance of each facility that you include toward the successful operation of the hatchery. **(10 Marks)**
- ii.** Outline the stages of development that the embryos in the quail eggs will undergo during incubation. **(10 Marks)**

**Q2** Imagine you have been employed by a 30,000 broiler rearing company where all the workers have been dismissed due to total negligence in their broiler rearing duties. You have been assigned to supervise the activities of the new group

of workers that is about to replace the dismissed ones. Upon visiting the 15 poultry houses, each having the capacity for 2,000 birds, you see large pools of stagnant rain water outside the houses. Just as you enter some of the buildings you are hit by a strong irritating pungent smell coming from inside. Inside you notice the chicks are mostly huddled in the corners. The chicks only have wing and tail feathers developed and yellow down feathers cover the other parts of the body. The birds look weak and rather small in size. Their droppings generally show stains in different variations of the colour red. Most feeders and drinkers are empty and the feed storage room is empty. You are informed that there have been high mortalities from all the houses but there are no records available.

- i. According to your assessment of the situation, explain what could have caused the high chick mortality. **(8 marks)**
- ii. What is the physiological and/or biochemical basis for your assessment? **(5 marks)**
- iii. What measures would you take to save the remaining flock? **(7 marks)**

**Q3.** Mr Happy Nama is the Animal Production Officer for an organization that is promoting poultry production in youth groups in Mufumbwe District. The Camp Officer for Mufumbwe East comes to him for advice on how to assist a youth group in her area which has been rearing commercial layers for 10 weeks. They require information on how to cull hens which are not laying and those that are not producing eggs economically.

- i. What advice should he give her? **(12 marks)**
- ii. What is the physiological basis for the advice to be given? **(8 marks)**

## **SECTION B      INDIGENOUS/VILLAGE CHICKEN PRODUCTION**

**Q1** Indigenous or village chicken production is an important agricultural activity of almost all rural communities in Zambia. However, the sector has shown minimal growth despite its importance due to several constraints that have hampered the growth of the sector.

- i. List six (6) benefits of village chicken rearing to rural households. **(5 marks)**

- ii. List five (5) factors (constraints) that have hampered the growth of the sector  
(5 marks)
- iii. What strategies can you advise the farmers to adopt in order to improve village chicken production and productivity in Zambia?  
(3 marks)

**Q2** What three (3) challenges are associated with having a high stocking density in village chicken production?  
(3 marks)

**Q3** The Animal Genetic Resource Centre in Mazabuka, Zambia is a Research Institute involved in preservation of indigenous/ village chicken genetic resource.

- i. Name three (3) village chicken types which the centre is preserving.(3 marks)
- ii. Give one reason why preservation of village chicken genetic resource is important.  
(1 mark)

## **SECTION C PIG PRODUCTION**

**Q1** List five (5) criteria that you would use, respectively, for the selection of breeding gilts or sows and for breeding boars.  
(5 marks)

**Q2** Weaning in pig production is done by separating or removing the sow from her litter. Thereafter consumption of milk by the piglets ceases. What would you consider to be the best weaning age for piglets? What are the advantages and disadvantages of weaning piglets at the selected age, as opposed to weaning them earlier or at an older age.  
(10 marks)

**Q3** Explain the significance of the different protein levels recommended for the five (5) Zambia Bureau of Standards commercial pig feeds.  
(5 marks)

**END OF EXAMINATION**

**UNIVERSITY OF ZAMBIA  
SCHOOL OF AGRICULTURAL SCIENCES**

**2016/17 ACADEMIC YEAR SUPPLEMENTARY EXAMINATION-NOVEMBER  
2017**

**ANIMAL HEALTH (AGA 5712)**

**Duration:** 3 hours

**INSTRUCTIONS:**

1. Please read the instructions and each question carefully
2. Answer **ALL** questions.
3. Write the answers to each question in a separate examination answer book.
4. **ALL** questions carry equal marks.
5. Write in a legible handwriting.

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**QUESTION 1**

You are the manager at a farm that keeps a large herd of goats and sheep and a 200-sow unit piggery. As parasitic diseases cause considerable economic losses, you are tasked to come up with a control program that ensure that these losses are kept to a minimum.

- a) For each of the animal species at your farm, list the parasites you would worry about. **(6 marks)**
- b) In the goat population, which of the parasites listed in (a) above is a major cause of mortality and how would you control it in your herd. **(6 marks)**
- c) Outline measures you would undertake to prevent the occurrence of parasitic diseases on your farm. **(6 marks)**
- d) The use of anthelmintics is commonly used to control parasites in farm animals, outline measure you would undertake to reduce the possibility of anthelmintic resistance developing at you farm. **(2 marks)**

**QUESTION 2**

Animal diseases constitute a major obstacle to livestock production in Zambia. However, animals counteract diseases through several protective mechanisms and barriers.

- a) Outline the physical barriers by which animals counteract infection. **(5 marks)**
- b) With the aid of a table, show the differences between primary and secondary immune responses in cattle following administration of two doses of a vaccine 4 weeks apart. **(5 marks)**
- c) Outline the major cells of the immune system and their functions. **(5 marks)**
- d) List the primary and secondary immunological organs. **(5 marks)**



**QUESTION 3**

Write short but concise notes on the following:

- a) Clinical signs and control of Theileriosis. (10 marks)
- b) Postmortem signs and diagnosis of Cowdriosis. (10 marks)

**QUESTION 4**

Infectious diseases result from invasion of susceptible animals by microorganisms through various routes, and their subsequent proliferation and spread in the animal body to exert their effects on the host.

- a) Outline the various routes of infection. (5 marks)
- b) Lists any five (5) factors that affect the outcomes of infection. (5 marks)
- c) List the types of infectious agents and state how they cause disease. (5 marks)
- d) Briefly describe the similarities and difference between passive and active immunity. (5 marks)

**QUESTION 5**

Write short but concise notes on the following

- a) Effects of livestock disease on livestock productivity and human welfare. (5 marks)
- b) Depopulation as a method of disease control. (5 marks)
- c) The tick, *Rhipicephalus appendiculatus*. (5 marks)
- d) Direct losses associated with infestation of cattle with ticks. (5 marks)

.....END OF EXAMINATION .....



**The University of Zambia**

**School of Agricultural Sciences  
Department of Plant Science**

**Third Year Examination for Bachelor of Agricultural Sciences  
AGC 3121: CROP PRODUCTION  
Supplemental Examination 2017**

Date: 2<sup>nd</sup> November, 2017

Time: 09:00 – 12:00 HRS

Venue: Omnia 2

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**Instructions**

1. Answer all questions
2. Marks are as indicated

**Question 1**

Indicate True or False

- a. Wheat belongs to the family Fabaceae.
- b. In Agro-ecological Region II, 500-700 series of Maize varieties are planted.
- c. Stalk borer is one of the pests of Maize.
- d. Maize streak is a viral disease transmitted by grasshoppers.
- e. Soil is the chief limiting factor in paddy Rice production.
- f. Compound D fertilizer is used as a precaution against Boron deficiency.
- g. In irrigated Wheat production, the major weed problem is volunteer Soyabeans.
- h. In Cotton, the critical period of weed competition is 2 to 7 weeks after planting.
- i. When thinning Cotton, 4 seedlings are left per station.
- j. The legislation for compulsory uprooting and burning of Cotton plants after harvest is enacted on 1<sup>st</sup> October every year.
- k. Finger millet is the staple food in northern parts of Zambia.
- l. The centre for Rice research is called the International Rice Research Institute (IRRI).
- m. The centre for Rice research is based in India.
- n. The centre for Maize Research is Called International Maize and Wheat Research Institute.
- o. The centre for Maize research is based in the Phillipines.
- p. The moisture content for storage of Millet grain is 10%.

**(16 marks)**

**Question 2**

- a. Outline the economic importance of Wheat (*Triticum spp*) **(10 marks)**
- b. A farmer has acquired virgin land and would like to prepare it for planting. Briefly describe how this is done indicating the importance of level of tilth. **(8 marks)**

### Question 3

As an Agronomist for Mpika District, you have been requested to give 2 presentations to 2<sup>nd</sup> Year Zambia Agricultural College students taking a course in Crop Production. What would you include in the following presentations:

Birds on Sorghum (*Sorghum bicolor*) crop.

(8 marks)

Methods used when planting Rice (*Oryza sativa*)

(8 marks)

### Question 4

i) Briefly describe the major growth factors for crop production.

(10 marks)

ii) Data on the performance of the maize crop which you grew at the Field Station in 2017 growing season is given in Table 1. From the data presented, explain the crop growth factors with the greatest influence on your maize crop.

(15 marks)

Table 1: Plants traits evaluated

Plant	Plant height (cm)			Plant thickness at base (cm)			Chlorophyll Index			Cob thickness (cm)			Colour of silk		
	Row 5	Row 15	Row 30	Row 5	Row 15	Row 30	Row 5	Row 15	Row 30	Row 5	Row 15	Row 30	Row 5	Row 15	Row 30
1	149	190.2	61.0	7.8	8.0	3.4	56.8	62.5	15.4	0.0	3.2	0.0	N/A	Light green	N/A
2	176	190.6	89.0	10.9	8.0	4.4	30.4	33.4	11.7	4.2	3.8	0.0	N/A	N/A	N/A
3	150	190.8	121.0	10.7	8.9	6.0	25.4	27.9	14.4	0.0	5.6	0.0	N/A	N/A	N/A
4	108	190.3	111.0	10.0	7.8	6.0	37.7	41.5	15.8	0.0	4.0	0.0	N/A	N/A	N/A
5	119	190.0	84.0	8.4	8.2	7.4	43.0	47.3	19.8	0.0	4.1	0.0	N/A	Pinkish	N/A
6	117	190.3	100.0	7.6	8.8	6.2	36.7	40.4	15.2	0.0	3.2	0.0	N/A	N/A	N/A
7	151	190.6	82.0	8.0	8.0	7.1	23.8	26.2	4.5	0.0	5.7	0.0	N/A	N/A	N/A
8	138	190.6	91.0	8.4	9.0	9.2	63.6	70.0	7.8	0.0	4.5	0.0	N/A	Light green	N/A
9	150	190.2	98.0	8.5	7.8	8.3	37.8	41.6	13.1	0.0	2.9	0.0	N/A	Light green	N/A
10	136	191.0	111.0	7.9	8.2	6.5	37.4	41.1	14.7	0.0	3.2	0.0	N/A	N/A	N/A

Key:

N/A - Not applicable

### Question 5

In the maize project which you carried out at the Field Station in 2017 growing season, the Neutron moisture probe was used to measure soil moisture content.

i) What is the advantage of this method compared to other methods of measuring soil moisture content?

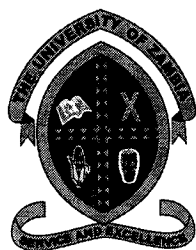
(8 marks)

ii) Explain the performance of the maize plants in Row 5 and Row 15 with respect to water uptake.

(12 marks)

iii) Why is soil moisture content with the Neutron moisture probe not measured above 15 cm? (5 marks)

**END OF EXAM**



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

**SUPPLEMENTARY EXAMINATIONS**  
**2016/17 ACADEMIC YEAR**

**COURSE:** AGRICULTURAL MARKETING AND PRICING  
**CODE:** AGE 4142  
**DATE:** 3<sup>rd</sup> NOVEMBER 2017  
**TIME:** 09:00 - 12:00 HRS

**INSTRUCTIONS TO CANDIDATE**

1. This examination paper has two sections. Section A has Forty (40) multiple-choice questions worth 60 points and Section B has two (2) questions (with parts) worth 40 points making 100 points in total for the whole paper.
2. Answer all questions from both sections.
3. Clearly show your work in your answers to Section B questions to get full credit.
4. Please be concise in answering the questions and write legibly.

**Section A (1 ½ points each question)**

1. Which of the following sentences correctly describes the concept of substitution effect in the context of consumer demand?
  - a. It is the change in the amount of a good that would be consumed as the price of that good changes, holding constant all other prices and the level of utility
  - b. It is the change in the amount of a good that would be consumed as the price of that good changes, holding constant all other prices but at different utility levels
  - c. It is the change in the amount of a good that a consumer would buy as purchasing power changes, holding all prices constant
  - d. It is the substitution of one good for another
  
2. Which of the following reasons is **TRUE** regarding why agricultural commodity prices in Zambia may be more volatile than prices of most non-farm goods and services?
  - a. There is no time lag between decision to produce and realisation of output
  - b. Agricultural output production has less yield variability
  - c. Agricultural production is largely concentrated among large-scale farmers
  - d. There is a time lag between decision to produce and realisation of output
  
3. Demand of a product with an own-price elasticity of - 3.5 is classified as:
  - a. Perfectly inelastic
  - b. Inelastic
  - c. Unitary elastic
  - d. Elastic
  
4. If the cross price elasticity of good x in terms of good y is 1.80, we say the two goods are:
  - a. Complements
  - b. Substitutes
  - c. Both complements and substitutes
  - d. Not economically related

**Answer questions 5 and 6 based on the following demand equation for product B.**

$$Q_B = 40 - 2 P_B + 5 P_M - 2.5 P_V + 0.02 \text{ INC}$$

5. Which one of the following sentences is **TRUE** about product B?
  - a. It is a normal good
  - b. It has no complements
  - c. It has no substitutes
  - d. It is an inferior good
  
6. What is the inverse demand for product B?
  - a.  $P_B = 40 - 2 Q_B + 5 P_M - 2.5 P_V + 0.02 \text{ INC}$
  - b.  $P_B = 40 - 0.5 Q_B + 2.5 P_M - 1.25 P_V + 0.01 \text{ INC}$
  - c.  $P_B = 20 - 0.5 Q_B + 2.5 P_M - 1.25 P_V + 0.01 \text{ INC}$
  - d.  $P_B = 20 - 2 Q_B + 5 P_M - 2.5 P_V + 0.02 \text{ INC}$

7. Suppose Shoprite reduces the price of bread in all its retail outlets from K10/loaf to K8/loaf without any influence from external factors. What effect would this have on demand for shoprite bread?
  - a. This would lead to a rightward shift in the demand curve
  - b. This would lead to an increase in the quantity of bread demanded along the same demand curve
  - c. This would lead to a leftward shift in the demand curve
  - d. This would lead to a decrease in the quantity of bread demanded along the same demand curve
  
8. The homogeneity condition states that:
  - a. The sum of the own- and cross-price elasticities and the income elasticity for a particular commodity is, taking account of signs, zero
  - b. The weighted sum of the income elasticities for all items in a consumer's budget is one
  - c. If the price for one commodity changes, the price of its substitutes tend to change as well, but by varying amounts
  - d. There is symmetry between elasticities of substitutes
  
9. If the price elasticity of supply of soya bean is unitary, it implies that the change in its price is:
  - a. Greater than the change in quantity supplied by producers
  - b. Less than the change in quantity supplied by producers
  - c. Equal to the change in quantity supplied by producers
  - d. Equal to the change in quantity demanded by consumers
  
10. When a shift in demand is greater than a shift in supply but both are in the positive direction, the equilibrium price is likely to:
  - a. Remain constant
  - b. Fall
  - c. Rise
  - d. Fluctuate
  
11. A monopolistic firm would find the business of supplying round-up herbicide profitable if the own price elasticity of demand of round-up herbicide in Zambia is:
  - a. Inelastic
  - b. Perfectly inelastic
  - c. Elastic
  - d. Perfectly elastic
  
12. Which of the following is **NOT** a pricing strategy used by oligopolistic firms in agricultural products markets?
  - a. Cartel pricing
  - b. Competitive pricing
  - c. Predatory pricing
  - d. Price leadership pricing

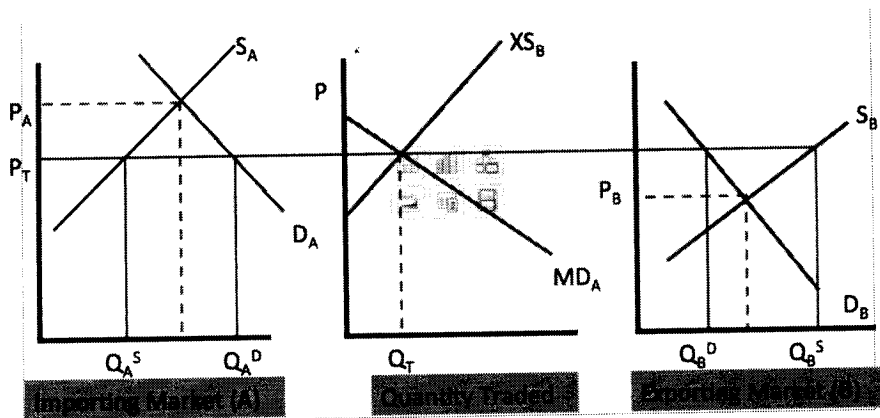
13. If the concentration ratio in the livestock feed industry in Zambia is 45%, this can be interpreted as a:
- No concentration level industry
  - Low concentration level industry
  - Medium concentration level industry
  - High concentration level industry
14. Which one of the following indicators is used to assess market structure in the market structure, conduct and performance model?
- Market concentration
  - Price decisions
  - Non-price decisions
  - Price efficiency
15. Soya bean production relies heavily on application of inoculant for better yields. Suppose the price of inoculant increases, this is likely to lead to:
- A leftward shift in supply of Soya beans
  - A rightward shift in supply of Soya beans
  - No effect shift in supply of Soya beans
  - A rightward shift in demand for Soya beans
16. Suppose supply of day old chicks is now under one profit maximising monopolist with  $TR = 1400Q - 6Q^2$  and  $TC = 1500 + 8Q$ . What would be the price (in Zambian Kwacha – ZMW) of each day old chick supplied by the monopolist?
- ZMW 116
  - Less than ZMW 116
  - Greater than ZMW 116
  - ZMW 1400
17. The difference between the price paid by consumers and that obtained by producers at retail outlets is called:
- Marketing margins
  - Derived demand
  - Primary demand
  - Derived supply
18. It takes a 150kg porker raised by a farmer to produce 80kg of retail pork. Based on the farm to retail price spread concept, the conversion factor is:
- 150
  - 1.88
  - 0.53
  - 80
19. Marketing bill covers foods consumed both at home and away from home but excludes \_\_\_\_\_ produced foods:
- Foreign
  - Domestically
  - Retail
  - Industry

20. \_\_\_\_\_ consists of a fixed quantity of a country's farm originated food to track the food price changes in grocery stores over a given time.
- Farm to retail price spread
  - Marketing bill
  - Market basket
  - Marketing margin
21. Analysis of relationships among the prices of different grades is, for the most part, a special case of price relationships among:
- Complements
  - Substitutes
  - Both complements and substitutes
  - None of the above
22. The empirical approach used to measure price differences using data collected on transactions prices and on the attributes of the transactions is generally called the \_\_\_\_\_ preference approach.
- Revealed
  - Stated
  - Revealed and stated
  - None of the above
23. The empirical approach used to measure price differences using experimental auctions is generally called the \_\_\_\_\_ preference approach.
- Revealed
  - Stated
  - Revealed and stated
  - None of the above
24. \_\_\_\_\_ is a price that is offered to a supplier for a high quality product.
- Premium and discount
  - Discount
  - Premium
  - None of the above
25. \_\_\_\_\_ is a price that is offered to a supplier for a relatively low quality product.
- Premium and discount
  - Discount
  - Premium
  - None of the above
26. Suppose the price of UHT milk in New Zealand decreases by 10% causing a decrease in price of UHT milk in Zambia by 5%, the price transmission elasticity is:
- 2
  - 1
  - 10
  - 0.5



27. Consider two markets, market A and market B. Goods can move (be traded) from market A to B on condition that:
- The difference between the price in market B and that of market A is greater than or equal to transfer costs
  - The difference between the price in market B and that of market A is less than transfer costs
  - The difference between the price in market A and that of market B is greater than or equal to transfer costs
  - All the above
28. Consider the price of Soya beans at two time periods;  $P_{t+1}$  (future period) and  $P_t$  (current period). The condition for storing the Soya beans in order to sell it at price  $P_{t+1}$  and not  $P_t$  is that:
- The difference between  $P_{t+1}$  and  $P_t$  is greater than or equal to storage costs
  - The difference between  $P_{t+1}$  and  $P_t$  is less than storage costs
  - The difference between  $P_t$  and  $P_{t+1}$  is greater than or equal to storage costs
  - All the above
29. What is the term used by agricultural policy analysts to describe the challenge policy makers face to ensure that agricultural commodity prices are sufficiently high for food producers but low enough to be affordable to consumers?
- Food production dilemma
  - Food price dilemma
  - Food marketing dilemma
  - Food processing dilemma
30. What type of contract would a vertically integrated horticultural company most likely get into with its smallholder out grower members?
- Processing contract
  - Marketing contract
  - Production contract
  - Vertical contract
31. Which of the following is one of the common weaknesses of agricultural cooperatives?
- Low standards of performance
  - Bad management
  - Financial failure
  - All the above
32. The medium term component of a price time series that consists of the gradual ups and downs that do not repeat each year is called the:
- Long-term trend
  - Seasonal component
  - Cyclical component
  - Irregular component

Answer questions 33 and 34 based on the following three-panel diagram.



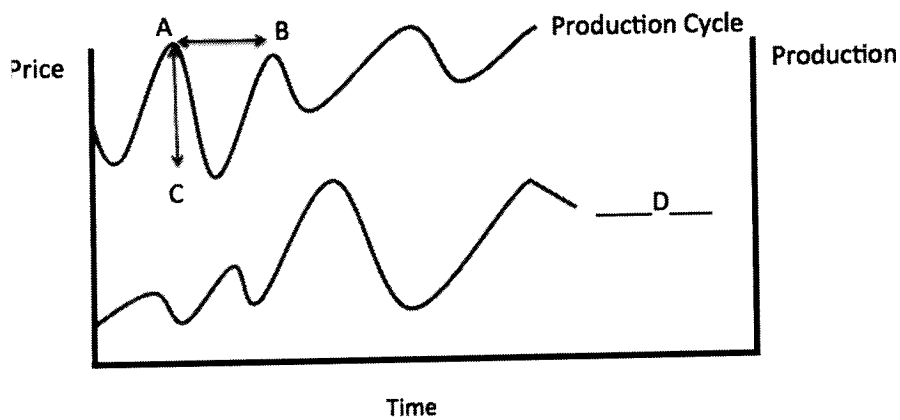
33. What is the difference between  $Q_A^D$  and  $Q_A^S$  called?

- Excess demand
- Excess supply
- Import parity
- Export parity

34. What is the difference between  $Q_B^S$  and  $Q_B^D$  called?

- Excess demand
- Excess supply
- Import parity
- Export parity

Answer questions 35 - 36 based on the following diagram.



35. What is the distance between A and B called?

- Length
- Amplitude
- Trough
- Peak

36. What is the distance between A and C called?

- Length
- Amplitude
- Trough
- Peak

Answer question 37 - 40 based on the following regression output reporting the relationship between quantity of meat demanded (kg) in Zambia over time and eight explanatory variables: (1) price of meat in kwacha/kg (P Meat); (2) price of eggs in kwacha/unit (P Eggs); (3) P Dairy in kwacha/litre (P Dairy); (4) price of fats in kwacha/kg (P Fats); (5) price of cereals in kwacha/kg (P Cereals); (6) price of sweets in kwacha/kg (P Sweets); (7) Household income (Income), and; (8) Annual population (Population).

### SUMMARY OUTPUT

Regression Statistics	
R Square	0.99
Adj. R Square	0.99
Observations	70

ANOVA			
	df	F	Significance F
Regression	8	1744.1	0.000005
Residual	61		
Total	69		

	Coefficients	P-value	Lower 95%	Upper 95%
Intercept	-20513.75	0.000003	-28542.20	-12485.30
P Meat	-13306.31	0.000074	-19568.65	-7043.98
P Eggs	-7430.63	0.070154	-15491.71	630.44
P Dairy	151233.31	0.000002	107663.95	194802.69
P Fats	-5843.09	0.185050	-14559.15	2872.97
P Cereals	-37970.12	0.013007	-67644.96	-8295.29
P Sweets	6799.16	0.148760	-2497.61	16095.94
Income	14.14	0.008064	3.82	24.46
Population	229.36	0.000006	155.28	303.44

37. What is the correct interpretation of the coefficient of determination of these regression results?
- The X variables taken together explain 1% of the variance of quantity of meat demanded
  - The X variables taken together explain 99% of the variance of quantity of meat demanded
  - The X variables taken together explain 100% of the variance of quantity of meat demanded
  - The X variables taken together explain 0% of the variance of quantity of meat demanded
38. From these results, which of the explanatory variables listed below is not statistically significant in explaining the variation in the quantity of meat demanded?
- P Meat
  - Income
  - P Dairy
  - P Sweets

39. What is the effect of the price of meat ( $P_{\text{Meat}}$ ) on the quantity of meat demanded?
- The effect of the price of meat is that with an increase in price of K1/kg, the quantity of meat demanded increases by 13306.31kg holding all other factors constant
  - The effect of the price of meat is that with an increase in price of K1/kg, the quantity of meat demanded reduces by 13306.31kg holding all other factors constant
  - Price of meat has no effect on quantity of meat demanded
  - None of the above
40. Based on the coefficients on explanatory variables, what product is a meat substitute?
- Eggs
  - Dairy
  - Fats
  - Cereals

**Section B (points in parenthesis)**

1. Consider two sweet potato producing regions, Region A and B. Region A has excess supply ( $Q^{XS} = -80 + P$ ) and Region B has excess demand ( $Q^{MD} = 40 - 0.2P$ ). *Please note that prices are in US\$/tonne and quantities are in thousand tonnes.*
  - a. Suppose transfer costs prohibit trade between the two regions, compute the market clearing prices of sweet potatoes in the two regions. **(4 points)**
  - b. Now, suppose a new policy is introduced that eliminates transfer costs, compute the market clearing price and quantity traded between the two regions. Depict these on a well-labelled supply and demand diagram. **(10 points)**
  - c. Which economic actors would gain and which ones would lose as a result of the change in policy? For each type of economic actor, please ensure to explain why they would gain or lose. **(6 points)**
  
2. Suppose the retail price of tomato is K20 per kilogram while the farm gate price of tomato is K9 per kilogram.
  - a. What formula would you use to compute the farm to retail price spread of tomato? Ensure to clearly define all the key parameters. **(5 points)**
  - b. What reasonable assumption would you make about the conversion factor in this tomato example? Explain your answer. **(4 points)**
  - c. Compute the farm to retail price spread of the tomato case presented above and interpret your answer. **(6 points)**
  - d. List five determinants that generally influence farm to retail price spreads of agricultural products. **(5 points)**

---- The End ----



THE UNIVERSITY OF ZAMBIA  
SCHOOL OF AGRICULTURAL SCIENCES  
2017 SUPPLEMENTARY EXAMINATIONS

**AGE 5241 – PRINCIPLES OF FARM MANAGEMENT**

**TIME: THREE HOURS**

**INSTRUCTIONS: ANSWER ALL FIVE QUESTIONS**

---

1. *A.* Identify and discuss the four reasons for keeping farm accounts and records. Why doesn't an average Zambian farmer keep records?(10 marks)
- B.* Suppose a farm experiences a decline in its current ratio from 1.8 to 1.2. Is this a favourable change? What factors might explain the decline in the ratio?  
(10 marks)
2. Identify the types of risk and uncertainty faced by farmers. Discuss the various safeguards farmers and/or Governments use against these risk and uncertainty in the farming business.(20 marks)
3. Mr Londe is thinking of installing a grain drier for his 170 ha maize crop. He normally produces 62 bags (90kg)/ ha. With the drier he would harvest the whole crop earlier than usual.  
The lowest quotation for a suitable plant was given by Agro-industries Limited for K29,040 installed. It would also cost Mr. Londe K10, 000 to erect a suitable building. The expected life of a drier is five years and the estimated variable costs, including labour; of reducing grain moisture content by 6% is K5.40/tonne.  
Agro-industries claim that earlier harvesting and drying has proved to raise yield by 7% or more by reducing losses due to lodging, termites and vermin- both two- and four legged. They also say that farmers should raise yield by 6 bags/ha and reduce land preparation cost by ploughing earlier. Being shrewd, Mr. Lombe halves these claims though he agrees that they could be true.  
Using this information, he wants to assess the worth of the proposal by partial budgeting.

**Assume:**

- With regard to interest on his investment, he will charge 10% a year on the average investment.
- Shelling and transport would cost K90/tonne.
- Maize is worth K78/90kg bag.

How would you advise Mr. Londe? *(20 marks)*

4. Assume that a farmer has the following resources available for producing hogs and feeder cattle and that each unity of production requires the indicated resources. The appropriate data are shown in the following table:

RESOURCES		REQUIREMENTS	
KIND	AMOUNT	HOGS/ LIT	F. CATTLE/HD
Maize	3,000	100	55
Labour	1,500	22	12
Capital	3,000	70	180
Facilities			
For hogs	80	1	-
For cattle	100	-	1
Gross margin		60	37

By plotting information from the table on a graph, find the production possibility curve and the most profitable point of operations for these conditions. What will be the total gross margin that this farmer realises at this point? *(20 marks)*

5. A. State what you understand by the term enterprise budget. Discuss the use of this document of the farm? *(10 marks)*
- B. Machinery and equipment expenses represent a major category of costs in crop production. However a consistence method of estimating machinery and equipment costs is needed for use in preparing enterprise budgets for both crop and livestock alternatives. Discuss reasons why it is important for farm managers to estimate machinery and equipment costs? *(10 marks)*

**THE UNIVERSITY OF ZAMBIA**  
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**SUPPLEMENTARY EXAMINATIONS FOR 2016/2017 ACADEMIC YEAR**  
**AGE 5251: AGRICULTURAL PROJECT PLANNING AND APPRAISAL**  
**TIME: THREE HOURS**

**INSTRUCTIONS:**

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

1. a) Explain why the preparation and analysis and evaluation phases of the project cycle are important. (6 marks)  
 b) Describe and illustrate by use of diagrams and by giving examples; two scenarios where the distinction between the “with” and “without” and the “before” and “after” project comparisons is less crucial. (8 marks)  
 c) Explain briefly three problems that are related to poor project analysis. (6 marks)
2. a) Define 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 K'000				
Year	Investment Outlay	Operation and maintenance	Production Cost	Gross Benefit
1	450	0	0	0
2	400	0	0	0
3	350	0	0	0
4	300	0	0	0
5	300	0	0	0
6	0	40	60	1000
7	0	40	60	1100
8	0	40	70	1310
9	0	40	80	1370
10	0	40	90	1430

- 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 coffee processing plant 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 K15, 000 and the transportation to the project site is K8, 000. The official exchange rate (OER) is K9.50 to US\$1 and a foreign exchange premium of 20% is estimated.
- Calculate the economic import parity value at the farm gate or project boundary using the conversion factor approach. (7 marks)
  - Calculate the economic import parity value at the farm gate or project boundary using the shadow exchange rate approach. (7 marks)
  - What is the c.i.f. price in US\$ for a combine harvester at point of import if the import parity price at farm gate is K800, 000; the official exchange rate (OER) is US\$1=K9.50; the import duty is 10%; the domestic handling and marketing charges = K4, 000 and the internal transportation to project site is K6, 000? (6 marks)

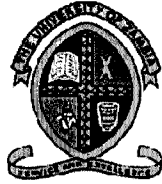
5. The foreign exchange component and the domestic currency component of a layers' cages project are as given in the following table:

Year	Foreign Exchange Component (US\$ '000)			Domestic Currency Component (K '000)	
	Value of Production	Investment Cost	Production Cost	Investment Cost	Production Cost
1	0	250	0	600	0
2	0	200	0	550	0
3	0	180	0	500	0
4	200	0	80	450	150
5	500	0	150	0	180
6	600	0	200	0	180
7	700	0	200	0	180
8	700	0	200	0	180
9	700	0	200	0	180
10	700	0	200	0	180

- If the opportunity cost of capital is 25%, compute the domestic resource cost (DRC). If the official exchange rate (OER) is K 9.50 to US\$1 and on the basis of the DRC you obtain, is the project favourable? Explain why? (10 marks)
- 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)
- What are the limitations and the advantages of DRC? Explain why it is important to estimate the DRC. (5 marks)

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**END OF EXAMINATION**



**THE UNIVERSITY OF ZAMBIA  
SCHOOL OF AGRICULTURAL SCIENCES  
2017 SUPPLEMENTARY EXAMINATIONS**

**AGE 5262 – INTERMEDIATE FARM MANAGEMENT**

**TIME: THREE HOURS**

**INSTRUCTIONS: ANSWER *ALL FIVE QUESTIONS***

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**Q1.**

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

**Q2.** Write short notes, giving examples, on the following:

- A. a system
- B. management information system
- C. preliminary controls
- D. concurrent controls
- E. feed back controls

**Q3**

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

**Q4.**

- A.** Discuss characteristics of agricultural labour. How would these characteristics help a manager to improve labour utilization?
- B.** . Outline the tasks of a manager with respect to labour acquisition and management

**Q5.**

- C.** Certain fundamental principals in relation to borrowing can be understood by observing some rules for borrowing funds. Discuss these rules.

**THE UNIVERSITY OF ZAMBIA**  
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**DEPARTMENT OF ECONOMICS AND EXTENSION**  
**2016/2017 ACADEMIC YEAR SUPPLEMENTARY EXAMINATION**  
**AGG3811: RURAL SOCIOLOGY**

**TIME: THREE (3) HOURS**

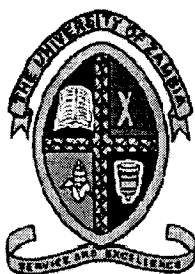
**TOTAL MARKS: 100**

**INSTRUCTIONS: ANSWER FIVE QUESTIONS ONLY.**

**EACH QUESTION CARRIES EQUAL MARKS**

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1. Define the concept gender and with cited examples explain at least three major agricultural development issues gender addresses (20 marks).
2. Contrast the following paired terminologies? (20 marks).
  - a) Social System and Culture
  - b) Conflict and cooperation
  - c) Prescribed role and enacted role
  - d) Values and Belief systems
3. "A family is both a primary group and a basic universal institution". (20 marks).
  - a) Define the term institution
  - b) Explain three major roles the family plays
  - c) State any two reasons why the family might be considered an arena of conflict in society?
4. With at least one example, provide sociological meanings to the following concept (20 marks).:
  - a) Competition
  - b) Ideology
  - c) Division of labor
  - d) Role model
  - e) Kinship system
5. Describe and state any two advantages and disadvantages associated to each one of the following forms of authority (20 marks).
  - a) Traditional,
  - b) Charismatic
  - c) Bureaucracy



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

2016 / 17 ACADEMIC YEAR - SUPPLEMENTARY EXAMINATION

COURSE: AGF 3042  
Instrumental Methods in Food Analysis - Theory

Date: Wednesday 1<sup>st</sup> November 2017

Time: 09 00 – 12 00 hours

Duration: THREE (3) HOURS

Venue: Omnia 2

**INSTRUCTIONS TO CANDIDATES:**

1. There are two (2) sections in this examination paper, Sections 1 and 2
  2. Answer **ALL** questions in **Section 1** and answer any **four (4)** questions in **Section 2**
  3. Each question in **Section 1** is allocated marks as shown in **parenthesis**
  4. **All** questions in **Section 2** carry equal marks of twenty **(20)** marks each
-

6. 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 mark)
- a. NMR
  - b. AAS
  - c. UV – Vis
  - d. MS
7. All the techniques listed here are immunochemically based techniques except \_\_\_\_\_ (1 mark)
- a. Radial Immunodiffusion
  - b. Radio Immunoassay
  - c. Electrofocussing
  - d. Particle Counting Immunoassay
8. The following are all examples of detectors used in HPLC except one. Which one is it? (1 mark)
- a. Refractive index
  - b. UV – Vis
  - c. Flame ionisation
  - d. Fluorescence
9. ECD is a detector that can do **ALL** the following except \_\_\_\_\_ (1 mark)
- a. Pesticide residues
  - b. Nitrogen containing compounds
  - c. Sulfur containing compounds
  - d. Selenium containing compounds
10. In ion exchange chromatography, three types of separations are possible except one. Which is the odd one out? (1 mark)
- a. Cationic from anionic components
  - b. Differently sized particles in solution
  - c. Ionic from nonionic compounds
  - d. Mixture of similarly charged species

11. Which technique cannot be used for any sugar analyses (1 mark)
- a. Thermogravimetric analysis
  - b. Polarimetry
  - c. Isoelectric focusing
  - d. Refractometry
12. One of the following is a buffer used for RNA electrophoresis. Mark the correct one? (1 mark)
- a. TPE
  - b. TEMED
  - c. MOPS
  - d. TAE
13. Which of the following enzyme is used as immobilised enzymes in ELISA (1 mark)
- a. Horse radish oxidase
  - b. Acidic phosphatase
  - c. Alkaline peroxidase
  - d. Horse radish peroxidase
14. Intensity of colour increases proportionally with the sample concentration in all the following except: (1 mark)
- a. Liebermann–Burchard
  - b. Flame Photometry
  - c. Competitive ELISA
  - d. Indirect ELISA
15. A sample has a D-value of 0.33. What does this mean? (1 mark)
16. (True / False) An Electron impact is a feature of a Mass Spectrometry (1 mark)
17. State one (1) advantage and (1) disadvantage of a capillary column when compared to a packed column? (2 marks)
18. Briefly describe the difference between a time domain spectra from a frequency domain spectra? (2 marks)

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

1. You are given a peanut butter sample and asked to determine the zinc content in the sample using a named spectrophotometric technique used for analyzing metals. Analyses were carried out in duplicate by weighing two aliquots of the peanut butter sample. The weights were 2.017 g and 2.002 g. After the analyses, you obtained results shown in **Table 1** for both the standard solutions and the duplicate samples. Answer the following questions:

**Table 1:** Absorbance and zinc concentration readings obtained from a spectrophotometric technique for a peanut butter sample and a set of zinc standard solutions

Standard	Tube / Flask #	Standard zinc solutions concentration mg / l	Absorbance readings
Standard solutions	1	0.00	0.01
	2	1.00	0.15
	3	2.00	0.21
	4	3.00	0.35
	5	4.00	0.43
	6	5.00	0.51
Peanut butter	1	?	0.38
Peanut butter	2	?	0.325

- a. Calculate the concentration of the zinc in the given samples and express your results as mean  $\pm$  standard deviation in mg / 100 g. **(10 marks)**
- b. Formulate an objective for this experiment. **(2 marks)**
- c. Write a discussion (at least half to full page) for this experiment. **(5 marks)**
- d. Give an appropriate conclusion for such an experiment. **(3 marks)**



2. Juice from a fruit (temperature 15°C) was extracted from a known citrus fruit tree.

The sample was measured for its ripeness using a simple field equipment. The reading obtained was taken at temperature 15°C and a refractive index of 1.38357.

Later in the day at noon (at 25°C), the reading was taken of the same juice (that was read in the morning) and it read a different reading. NB: Attached is a table

(Appendix 2) that can be used for this question. Answer the following:

a. Give the name of the equipment that is capable of making the readings that were taken of the juice at both instances. **(2 marks)**

b. Calculate the readings of the juice from the morning and noon readings and adjust them to 20°C. Express the adjusted readings (if, they are different) to % Brix. How do they compare? **(8 marks)**

c. Considering that the major component in the juice sample was sucrose. Express the two adjusted readings (again, if they are different) to another commonly used unit (include all units) **(4 marks)**

d. If you wanted to know the angle of rotation of this sample, you would use another equipment called a polarimeter. Draw a scheme of this equipment and label all the parts. **(6 marks)**

3. A protein sample was subjected to DSC in its native form and after pressure treating it at 600 MPa. The thermogram of the native protein showed two distinct depressions while the other one of the high pressure treated protein showed only one peak.

a. Discuss why there was this difference in the thermograms (native versus high pressure treated samples) and also what happened to the protein during the pressure treatment **(6 marks)**

b. To achieve the same effect as pressure treatment, what one (other) thing could you do to the protein to ensure similar results of the pressure results? **(2 mark)**

- c. If you wanted to know the molecular weights of the protein sample in question and number of subunits that the protein had. Explain in detail how you would do that and what technique you would use. **(12 marks)**
- 4.
- a. Compare and contrast sandwich ELISA and competitive ELISA **(10 marks)**
- b. Draw well labeled diagrams to support your answer in (a) **(10 marks)**
5. Discuss the principle of Gas chromatography (GC) coupled to a detector of your choice. In your discussion, include aspects of instrumentation, preparation of samples, principles of separation of samples, and sketch a typical chromatogram that would be obtained from GC, etc. **(20 marks)**

**THE END**

Appendix 2: Refractive indices @ 20 °C and corresponding Brix (% soluble sugars)

Refractive index	%Brix	Refractive index	%Brix	Refractive index	%Brix	Refractive index	%Brix
1.33299	0	1.37058	24	1.41587	48	1.47031	72
1.33442	1	1.37230	25	1.41795	49	1.47279	73
1.33587	2	1.37404	26	1.42004	50	1.47529	74
1.33732	3	1.37579	27	1.42215	51	<b>1.47781</b>	<b>75</b>
1.33879	4	1.37755	28	1.42428	52	<b>1.48055</b>	<b>76</b>
1.34027	5	1.37933	29	1.42642	53	<b>1.48291</b>	<b>77</b>
1.34175	6	1.38112	30	1.42858	54	<b>1.48548</b>	<b>78</b>
1.34325	7	1.38292	31	1.43075	55	<b>1.48808</b>	<b>79</b>
1.34477	8	1.38474	32	1.43294	56	<b>1.49069</b>	<b>80</b>
1.34629	9	1.38658	33	1.43515	57	<b>1.49333</b>	<b>81</b>
1.34782	10	1.38842	34	1.43738	58	<b>1.49598</b>	<b>82</b>
1.34937	11	1.39029	35	1.43962	59	<b>1.49866</b>	<b>83</b>
1.35093	12	1.39216	36	1.44187	60	<b>1.50135</b>	<b>84</b>
1.35249	13	1.39406	37	1.44415	61	<b>1.50407</b>	<b>85</b>
1.35407	14	1.39596	38	1.44644	62	1.50681	86
1.35567	15	1.39789	39	1.44875	63	1.50955	87
1.35727	16	1.39982	40	1.45107	64	1.51233	88
1.35889	17	1.40177	41	1.45342	65	1.51514	89
1.36052	18	1.40374	42	1.45578	66	1.51797	90
1.36217	19	1.40573	43	1.45815	67	1.52080	91
1.36382	20	1.40772	44	1.46055	68	1.52368	92
1.36549	21	1.40974	45	1.46266	69	1.52658	93
1.36718	22	1.41177	46	1.46539	70	1.52950	94
1.36887	23	1.41381	47	1.46784	71	1.53246	95

Source: Abbe Refractometer instruction Manual # 1055SN Advanced Type



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

BSc HUMAN NUTRITION

AGN 3222  
HUMAN NUTRITION

2016/2017 SUPPLEMENTARY EXAMINATIONS

Date: 02/11/2017

Time: 09:00 – 12:00 hrs

Duration: THREE (3) HOURS

Venue: Omnia 2

INSTRUCTIONS TO CANDIDATES:

1. Answer ALL questions and clearly number each.
2. There is a total of 100 marks
3. Calculators are permitted in this exam

**SECTION A (40 marks)**

1. Define the following terms: **(10 marks)**

- a. Basal Metabolic rate (BMR)
- b. Intra Uterine Growth Retardation (IUGR)
- c. Barker's Hypothesis
- d. Dietary diversity
- e. Nutrient retention factors

2. List **TWO (2)** factors that influence Basal Metabolic rate and explain how BMR is influenced by the named factors? **(4 marks)**

3. What is the recommended amount of fibre to be added to the diet of an adult/day? **(2 marks)**

4. Give **FOUR (4)** scenarios in which protein can be used as an energy source **(4 marks)**

5. Keeping in mind the caloric content of the three major macronutrients and their recommended intakes, give an example of a meal that contains approximately 400Kcal. **(5 m)**

6. Calculate the number of calories provided by the following meal? **(3 marks)**

110g (25g Protein) Fish Grilled with 1g Oil + 1 cup cooked mixed vegetables + 1 cup cooked rice (30g carbs)

7. List **TWO (2)** dietary sources of IRON and TWO of Selenium **(4 MARKS)**

8. Explain the role of folate in the human body **(3 marks)**

9. Early initiation of breastfeeding is one of the recommended infant and young child feeding practices in Zambia. List **THREE (3)** other recommendations **(3 marks)**

10. Explain why cold cut meats, raw unpasteurised dairy or under cooked meat and raw eggs are not recommended for pregnant women? **(2 marks)**

**SECTION B (60 marks)**

1. a. Explain the importance of food composition data (5 marks)
- b. Explain why it is necessary to have country specific food composition data (4 marks)
- c. List **THREE (3)** common errors in recipe calculations (3 marks)
- d. Compare and contrast the direct and indirect methods of compiling food composition data. (8 marks)

2. Complete the table below: (20 marks)

	<b>Vitamin E</b>	<b>Vitamin A</b>
<b>Dietary Sources</b>	i) ii) iii)	i) ii) iii)
<b>Functions</b>	i) ii) iii)	i) ii) iii)
<b>Two preventive measures of deficiency</b>	i) ii)	i) ii)
<b>Consequences of deficiency</b>	i) ii)	i) ii)

3. Mainess is a 20 year old female student in second year at the University of Zambia. She occasionally plays netball with "Unza social". The meal described below is typical of what she usually eats.

**450g** Nshima prepared from Breakfast meal

**60g** Egg relish

**50g** Fresh boiled rape

**1** Medium Orange weighing **35g**

**2 and 1/2** slices of Wheat bread weighing **125g**

**125ml** Whole cow's milk

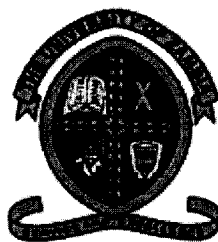
Sugar weighing **30g**

- i) Calculate the nutrient contribution of her food using the figures in the table below: indicate total nutrient contribution and whether there is a surplus or deficit (15 Marks)

Food item	Protein (g)	ME (Cal)	Vitamin C (mg)
Nshima (Breakfast Meal)	7	354	0
Eggs	13	158	-
Fresh cooked Rape	6.76	78	49.37
Orange (medium)	0.8	53	70
1 slice of Wheat bread	8	279	0
Cow milk (whole)	7	140	-
sugar	0	400	0
<b>Total Nutrients Contributed</b>	-----	-----	-----
<b>RDA</b>	<b>38g</b>	<b>3070</b>	<b>30</b>
<b>Surplus/Deficit</b>	-----	-----	-----

\*nutrient composition in the table is per 100g of edible portion

- ii) Assuming that her RDA is 2900cal energy, 48g protein, and 30mg vitamin C (Ascorbic acid), comment on whether this food meets her daily nutrient requirement and how her body will utilize these nutrients? (5 marks)



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

**BSc HUMAN NUTRITION**

**PRINCIPLES OF DIETETICS  
AGN 3232**

**2016/ 17 SUPPLEMENTARY EXAMINATIONS**

**DATE: 02/11/2017**

**TIME: 09:00H – 12:00H**

**DURATION: THREE (3) HOURS**

**VENUE: OMNIA 2**

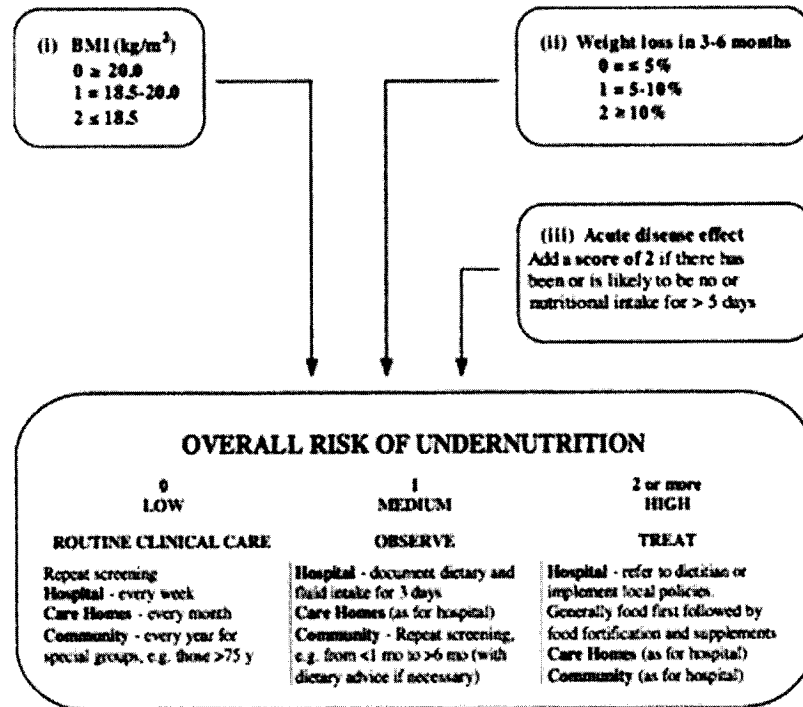
**INSTRUCTIONS TO THE CANDIDATES:**

- 1. THIS PAPER CARRIES 100 MARKS**
- 2. ANSWER ALL QUESTIONS**
- 3. ALL QUESTIONS CARRY EQUAL MARKS**



**Question 1**

The figure below shows a screening tool recommended by ESPEN.



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<sup>2</sup>).

- a) What screening tool is this and who does it target? (2 marks)
- b) Mr. Mweemba of Zingalume Compound is a hypertensive patient who reports that he lost 5 - 10% of his initial weight in the last month and has a BMI of 28 kg/m<sup>2</sup>. 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. Mr. Mweemba has a waist to hip ratio of 0.89 (3 marks)
    1. What type of body shape does he have?
    2. Describe the type of fat that he is most likely to have.
  - iii. From your answer in ii., do you think that Mr. Mweemba's BMI is a true representation of his current health status? Why? (3 marks)
  - iv. It has just been discovered that because of Mr. Mweemba's hypertension, he has now developed kidney failure.

1. Describe in detail the effect of high blood pressure on kidney function **(8 marks)**
2. Name two (2) nutrients that Mr. Mweemba will need to regulate in order to control his kidney failure, and why **(4 marks)**

### Question 2

- a) Describe in detail the different alcohol metabolic pathways. Be sure to mention the main location of activity, the alcohol intake level that activates the pathway and the extent of participation in alcohol metabolism. **(12 marks)**
- b) Explain how the following affect alcohol absorption and metabolism
  - i. Gender **(8 marks)**
  - ii. Ethnicity **(5 marks)**

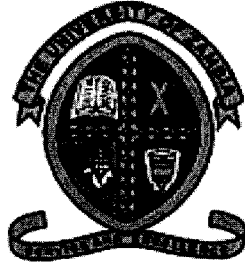
### Question 3

Aubrey is a sedentary 39 year old male with a BMI of 27 kg/m<sup>2</sup>. He has been diagnosed with diabetes and his doctor recommends that he loses weight in order for him to attain a healthy life.

- a) Provide four (4) ways in which one can control diabetes though diet. **(4 marks)**
- b) List two (2) foods that have a low glycemic index (GI) and explain why GI is important for Aubrey **(3 marks)**
- c) If Aubrey decides to consume white rice, pasta and potatoes which are high GI foods, give thee (3) ways in which he can lower the GI of these foods **(3 marks)**
- d) As Aubrey's dietician, you decide to use the Humanistic approach as a counseling tool to help him lose weight
  - i. Describe the Humanistic approach of counseling **(5 marks)**
- e) After successfully completing your counseling session with Aubrey, you devise a daily menu which reduces Aubrey's caloric intake by 250 kcal/day and you also advise him to increase his energy expenditure by 300 kcal/day.
  - i. How much weight will he lose in 6 months (26 weeks) if he consistently follows your dietary advice? **(7 marks)**
  - ii. Is this a safe weight loss? (Healthy weight loss is 0.2 – 1 kg/week) **(3 marks)**

#### Question 4

- a) It has been reported that vegetarian diets may be nutritionally adequate if they are well planned and a variety of fruits and vegetables are consumed.
- i. Describe the benefits of a vegetarian diet during adolescence and the nutrients of concern in this age range. Why are the nutrients you have listed of concern? **(6 marks)**
  - ii. Provide five (5) points to consider when planning a vegetarian diet? **(5 marks)**
  - iii. How would the consumption of a vegetarian diet help in the prevention of osteoporosis? **(6 marks)**
- b) Atrophic gastritis is a common disease in the elderly which leads to B12 deficiency
- i. Describe in detail how and why B12 deficiency occurs for this type of infection. Be sure to explain what happens to your food when ingested, all the way to the small intestines. **(8 marks)**



THE UNIVERSITY OF ZAMBIA  
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DEPARTMENT OF FOOD SCIENCE & NUTRITION

BSC HUMAN NUTRITION

AGN 5531 FOOD AND NUTRITION SECURITY  
**SUPPLEMENTARY EXAMINATION**

DATE: THURSDAY 2<sup>ND</sup> NOVEMBER, 2017

TIME: 09 – 12 HOURS

DURATION: THREE (3) HOURS

VENUE: OMNIA 2

**INSTRUCTIONS TO CANDIDATE**

1. THIS PAPER CARRIES 100 MARKS; 40 MARKS WILL BE ACCRUED FROM **PART A** AND 60 MARKS FROM **PART B**
2. DURATION OF THE EXAMINATION IS THREE (3) HOURS
3. ANSWER **PART A** AND **ANY FOUR (4)** QUESTIONS FROM PART B
4. MARKS ALLOCATED FOR EACH QUESTION ARE INDICATED

## Part A: Answer ALL Questions

1. Distinguish the following terms (**2 marks each**)
  - i. Food security
  - ii. Food insecurity
  - iii. Nutrition security
2. Identify and discuss the dimensions of food security (**8 marks**)
3. Discuss the challenges that face human kind in the ability to meet food security status (**3 marks**)
4. Outline and explain the types of food insecurity (**3 marks**)
5. Discuss the causes of household insecurity (**10 marks**)

## **Part B: Answer any four (4) Questions.**

**Marks are indicated against each question**

### **Question 1**

Demonstrate your understanding in using the conceptual framework for analyzing the determinants of household food security (**15 marks**)

### **Question 2**

- a. Outline and discuss the key dimensions of providing an enabling environment for food and nutrition security (**15 marks**)

### **Question 3**

- a. Zambia was recently reclassified as experiencing minimal acute food insecurity based on the integrated phase classification (IPC) scale. Discuss the levels and synergy characteristics within and between households in each of the IPC for food insecurity (**15 marks**)

### **Question 4**

- a. Food insecurity in a household can be seen as a combination of two (2) distinct problems; i.e. inability to acquire and utilize the food. Explain, using specific examples what each of these terms infer (**5 marks**)
- b. Discuss how women's empowerment programmes can be impacted positively to improve household food security (**10 marks**)

### **Question 5**

- a. Outline and discuss at least 6 guiding principles for the formulation and implementation of policy (**10 marks**)
- b. Explain the merits and demerits of using the FAO method for estimating undernourishment (**5 marks**)

**UNIVERSITY OF ZAMBIA**  
**SUPPLEMENTARY EXAMINATION -2017**  
**AGS 2110**  
**FUNDAMENTALS OF SOIL SCIENCE**

**DURATION:** 3.0 hours

**INSTRUCTIONS:** Answer FIVE QUESTIONS

**MARKS:** 100

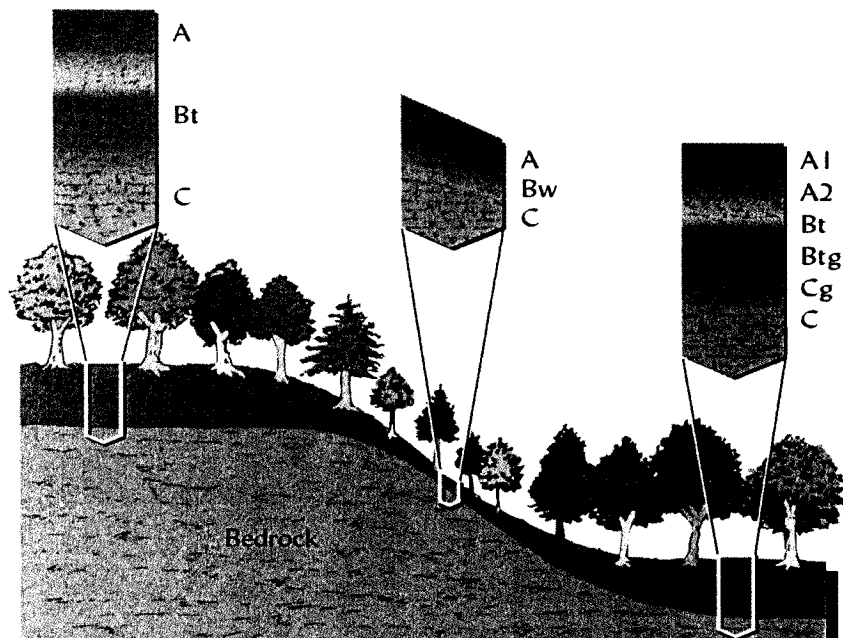
**SECTION A: ANSWER ALL THE QUESTIONS FROM THIS SECTION (QUESTIONS 1- 3)**

1. Define the following terms: ( 15 marks)

- a. Solum
- b. Streak of a mineral
- c. Exchangeable acidity
- d. Sodic soil
- e. Mineralization of nutrients
- f. Straight fertilizer

2. Answer the following questions ( 25 marks)

- a. Describe and explain three of the factors that influence and control soil formation (your answer should include an explanation of what the factors **ARE** and **HOW** they influence and control soil formation) ( 5 marks)
- b. The figure below displays three adjacent soil profiles



- i. Explain the main compositional differences among these three soil profiles (explain the horizons and sub-horizons as denoted by each letter). ( 5 marks)

- c. Soil structure
- Describe soil structure and provide three examples of soil structure ( 5 marks)
  - Describe the relationship between particle density and bulk density, and how these properties influence the movement of water and the growth of plants ( 4 marks)
- d. Weathering
- Describe the differences between chemical and physical weathering ( 2 marks)
  - Explain why weathering is said to combine the processes of destruction and synthesis, give examples ( 3 marks)
3. Answer the following questions briefly and concisely ( 20 marks)
- Write the chemical formulas of the minerals, calcite, quartz, and gypsum and indicate the chemical class to which each of them belong ( 5 marks)
  - Briefly describe how the Effective Cation Exchange Capacity (ECEC) of a soil is measured in the laboratory. (6 marks)
  - List and describe the three mechanisms by which nutrients in the soil reach the surface of plant roots. ( 4 marks)
  - Define the major components of the total water potential ( $\Psi_t$ ) of an unsaturated soil and describe how each component can affect the availability of water to plants. (5 marks)

***SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION.***

4. A moist soil sample obtained from the field with a volume of  $98 \text{ cm}^3$ , weighed 160 grams. Upon oven drying it weighed 140 grams. If the particle density of this soil is 2.65 grams answer the following: ( 20 marks)
- What is the gravimetric moisture content of this soil in %? ( 4 marks)
  - What is the volumetric moisture content of the soil in  $\text{cm}^3\text{H}_2\text{O}/\text{cm}^3$  soil? ( 4 marks)
  - What is the dry bulk density of this soil in  $\text{kg}/\text{m}^3$ ? ( 4 marks)
  - What percentage of total volume the soil is occupied by pores? ( 4 marks)
  - How many millimeters of water are present in a 20 cm layer the moist soil? ( 4 marks)
5. Students set up an experiment to determine the saturated hydraulic conductivity  $K_{\text{sat}}$  of a 10 cm layer of soil in a cylindrical vertical column with an internal diameter of 10cm. The soil column is covered by a 15 cm free column of water, which is maintained above the surface of the saturated soil. After 10 hours,  $600 \text{ cm}^3$  of water is collected in the vessel below the soil  
Answer the following: (20 marks)



a. What is the saturated hydraulic conductivity of the soil in cm/s? Use the bottom of the soil column as the reference level. (10 marks)

b. The soil moisture characteristic curve of a soil is described by the equation below:

$$pF = 2 - 10 \times [\Theta_v - 0.30]$$

where:  $pF = \log_{10}$  (suction in cm)

$\Theta_v$  = Volumetric moisture content of the soil ( $\text{cm}^3\text{H}_2\text{O}/\text{cm}^3$  soil)

Given that the suction of water at saturation in cm is about 1 cm, and that the matric potential of the soil at Permanent Wilting Point (PWP) corresponds to a suction of 15 bars and 0.1 bar at Field Capacity, (FC) answer the following: (10 marks)

i. Calculate the volumetric moisture contents of the soil at Field Capacity and at Permanent Wilting Point (6 marks)

ii. What is the water holding capacity of this soil in mm  $\text{H}_2\text{O}/\text{cm}$  soil? (4 marks)

6. Selected properties of soil from the Copperbelt are presented in the table below.

Depth cm	pH CaCl <sub>2</sub>	Bd g.cm <sup>-3</sup>	Ca <sup>2+</sup> meq/100g	Mg <sup>2+</sup> meq/100g	K <sup>+</sup> meq/100g	Na meq/100g	ECEC meq/100 g	Org C %	Tot N %	Avail P mg/kg
0-20	4.90	1.40	0.40	0.20	0.09	0.10	2.8	0.8	0.046	5.4

Answer the following questions. (20 marks)

a. What is the agronomic interpretation of the pH of this soil? (2 marks)

b. Calculate the Base Saturation of this soil. (3 marks)

c. Assuming the exchangeable acidity of the soil is present as exchangeable aluminium, how much agricultural lime with a neutralizing value of 80 % is required to reduce the aluminium saturation of this soil to 10 % for a Lima plot of this soil? (Note 1Lima= 0.25 ha). (5 marks)

d. A farmer wants to grow a crop of wheat that requires 140 kg N/ha, 26 kg P/ha and 108 kg K/ha. Would this soil be able to supply adequate amounts of P and K for the crop of wheat if all the K and P are in a form that can be taken in one season? Show all the calculations to support your answer. (10 marks)

**Useful data:**

**Atomic masses:** H=1, C=12, S=32, N=14, P=31, Mg=24, Ca=40, K=39, Na=23, Al=27, O=16.

**Useful constants** R=8.3145 Jmol<sup>-1</sup>.k<sup>-1</sup>.

**END OF EXAMINATION**

*SOIL SCIENCE IS FUN*



UNIVERSITY OF ZAMBIA

UNIVERSITY SUPPLEMENTARY EXAMINATIONS – NOV, 2017

AGS 3711: AGROCLIMATOLOGY

**Time:** Three (03) Hours

**Instructions:** Answer All Questions

**Total Marks:** 100

Non-programmable calculators are allowed

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1. Define the following terms.

**[15 Marks]**

- a. Actual vapor pressure
- b. Dew point temperature
- c. Radiative forcing
- d. Tropopause
- e. Weather
- f. Atmosphere

2. A government project wants to set up a standard automated meteorological station in Mwembeshi to serve the area. **[25 Marks]**

- a. How do atmospheric conditions affect crop agriculture and livestock rearing? **[5 Marks]**
- b. How would one use weather data for agricultural purposes? **[7 Marks]**
- c. Give an outline of how you would go about identifying the best suited site for a weather station. **[5 Marks]**

d. Outline the weather parameters that can be measured at such a station and how weather instruments would be laid out to obtain such measurements. **[8 Marks]**

3. A farmer obtained meteorological parameters of Lusaka, 15.5° S and 28.5° E, for 1<sup>st</sup> November 2017 from a meteorological station near his farm as shown in a table below.

**[20 Marks]**

Parameter	
Daily maximum air temperature	34 °C
Daily minimum air temperature	20 °C
Daily mean relative humidity	50 %
Expected clear sky shortwave radiation	25 MJ m <sup>-2</sup> d <sup>-1</sup>
Shortwave radiation	21 MJ m <sup>-2</sup> d <sup>-1</sup>
Average wind speed at 2 m	3 m s <sup>-1</sup>
Pan evaporation	7 mm
Surface albedo	0.3
Air pressure	96 kPa

Calculate the following,

- Mean saturation vapor pressure
- Actual vapor pressure
- Net shortwave radiation
- Net long wave radiation
- Net radiation

4. Agriculture production is said to have been highly impacted by climate change.

**[25 Marks]**

- a. What do you understand by climate change? **[2 Marks]**
- b. Describe a methodology of how one can go about ascertaining whether climate of an area has changed or not. **[6 Marks]**
- c. Discuss at least five expected impacts of climate change on agriculture in Zambia. **[10 Marks]**
- d. What measures has the government of Zambia put in place to reduce the impacts of climate change on agriculture? **[7 Marks]**

5. Write short notes on the following,

**[15 Marks]**

- a. Radiation depletion **[5 Marks]**
- b. Effects of radiation on plants **[5 Marks]**
- c. Air temperature and saturation vapor pressure **[5 Marks]**

**END OF EXAMINATION**



**UNIVERSITY OF ZAMBIA**  
**SUPPLEMENTARY EXAMINATIONS- OCTOBER 2017**  
**AGS 4232: SOIL FERTILITY AND AMENDMENTS**

**TIME:** Three (3) Hours

**INSTRUCTIONS:** Answer all Questions

**MARKS:** 100

1. Production of crops is hampered by various constraints which result in reduced yield. [25 marks]
  - a. List five (5) soil constraints to crop production. [10 marks]
  - b. What are the two strategies for attainment of maximum yield? [5 marks]
  - c. Integrated Soil Fertility Management (ISFM) is one of the options to improving crop yields. Discuss the management practices under ISFM in relation to soil fertility. [10 marks]
  
2. Fertilizers are materials that guarantee the minimum percentage amounts of nutrient elements required for plant growth and optimum yield. [25 marks]
  - a. What are the three (3) main mechanisms by which nutrient elements are lost from the soil? [6 marks]
  - b. On which plant parts do you expect nitrogen deficiency symptoms to occur? Explain your reasoning. [4 marks]
  - c. To determine potassium (K) in soil, 10 g of soil is equilibrated in 50 ml of 1 M ammonium acetate for 30 minutes, followed by filtration using filter paper. The concentration of K in the filtrate was found to be 4 mg/l: [15 marks]
    - i. Express the reading in mg/kg [5 marks]
    - ii. State whether this soil would meet the nutrient requirements for a crop that needs 70 kg of K per hectare. Show your calculation. (Assume a 20 cm plough layer with bulk density of 1.3 g/cm<sup>3</sup>) [5 marks]
    - iii. If deficient, how many 50 kg bags of compound D are required to meet the crop requirement for K? [5 marks]

3. A soil from Mpongwe has a Cation Exchange Capacity (CEC) measured at pH 7 of 4.0 cmol/kg soil and a pH value of 4.5 [25 marks]

- a. What are the implications of a low cation exchange capacity on soil quality? [8 marks]
- b. How can you increase the cation exchange capacity of this soil [5 marks]
- c. If the soil contains 30 % clay, calculate the CEC of the clay fraction assuming the measured CEC is due to clay only. What is the dominant type of clay present in this soil [6 marks]
- d. How much exchangeable potassium (kg/ha) can this soil retain to a depth of 20 cm assuming a bulk density of 1.3 g/cm<sup>3</sup>? [6 marks]

4. An acid soil from Kasama contains exchangeable acidity of 1.7 cmol/kg soil. [25 marks]

- a. What is the likely cause of acidity in this area? Justify your answer. [4 marks]
- b. Explain how soil acidity affects soil fertility [6 marks]
- c. Calculate the neutralizing values of the following liming materials [4 marks]
  - i. MgCO<sub>3</sub> [2 marks]
  - ii. Ca(OH)<sub>2</sub> [2 marks]

d. A liming material has a neutralizing value of 85 %. After a sieve analysis, the following results were obtained:

Fraction retained on 8 mesh (2449  $\mu$ m) sieve = 10 %

Fraction retained on 60 mesh (250  $\mu$ m) sieve = 20 %

Fraction passed through 60 mesh (250  $\mu$ m) sieve = 70 %

Calculate the Effective Neutralizing Value (ENV) of the lime. [5 marks]

- e. How many 50 kg bags of lime with an ENV calculated in (c) above are required to neutralize exchangeable acidity of the top 20 cm of one hectare of this soil, assuming a bulk density of 1300 kg/m<sup>3</sup>? [4 marks]
- f. State two (2) benefits of adding lime to acid soils? [2 marks]

**END OF EXAMINATION**