THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURE SCIENCES

EXAMINIATION PAST PAPERS FOR 2022/2023

AGA 2110 ANATOMY AND PHYSIOLOGY OF FARM ANIMALS

AGA 4532 PIG AND POULTRY PRODUCTION

AGA 4522 RABBITS AND DAIRY PRODUCTION

AGC 2042 SUSTAINABLE CROP PRODUCTION

AGC 3135 FUNDAMENTALS OF PLANT SCIENCE

AGC 3412 INTRODUCTORY HORTICULTURE

AGE 2122 FUNDAMENTALS OF MACROECONOMICS

AGE 3322 INTERMEDIATE MATHEMATICS FOR ECONOMICS

AGE 4142 AGRICULTURE MARKETING AND PRICING

AGE 4222 INTERMEDIATE AGRIBUSINESS MANAGEMENT

AGE 4322 APPLIED ECONOMETRICS

AGF 2262 FUNDAMENTALS OF ENGINEERING DRAWING

AGF 3042 INSTRUMENTAL METHODS IN FOOD ANALYSIS - PRACTICAL

AGF 3100 GENERAL AND FOOD MICROBIOLOGY (THEORY)

AGF 3412 FOOD TOXILOGY

AGF 4052 SENSORY EVALUATION OF FOOD

AGF 4210 UNIT OPERATION AND FOOD ENGINEERING THEORY

AGF 4300 FOOD PROCESSING AND PACKAGING

AGF 4422 WATER AND FOOD WASTAGE TREATMENT THEORY

AGG 2742 AGROMETROLOGY CLIMATE CHANGE AND FOOD SECURITY

AGG 3822 AGRICUTURAL EXTENSION

AGG 3832 FORAGE CROP PRODUCTION AND RANGE MANAGEMENT

AGG 3842 INTRODUCTORY STATISTICS FOR AGRICULTURE

AGN 2212 PRINCIPLES OF HUMAN NUTRITION

AGN 3222 HUMAN NUTRITION

AGN 4122 NUTRIENT AND DRUG INTERACTION

AGS 2110 FUNDAMENTALS OF SOIL SCIENCE

AGS 2142 LAND USE PLANNING

AGS 2642 INTRODUCTORY LAND HUSBANDRY

AGS 3312 SOIL PHYSICS

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGA 2110: ANATOMY & PHYSIOLOGY OF FARM ANIMALS

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has two sections A and B
2. Use a separate answer booklet for each section
3. There are six questions in this paper
4. You are required to answer a total of **FIVE (05)** questions.
5. All questions carry 20 marks
6. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A

QUESTION ONE

With regard to the animal reproduction;

A. Use a well-illustrated diagram to show the components of the female reproductive system in livestock. **(6 Marks)**
B. What are the accessory glands found in male livestock? **(4 Marks)**
C. Where would you find and what is the role of the retractor penile muscle? **(4 Marks)**
D. Draw and label a spermatozoon? State the function of two parts of this cell **(4 Marks)**
E. What are the functions of the gonads found in domestic animals? **(2 Marks)**

QUESTION TWO

The respiratory system refers to those organs involved in the exchange of gases between the blood and the external or environment.

A. State four functions of the circulatory system **(8 marks)**

B. List down five organs involved in respiration and write short notes on any three of the listed organs with regards to their anatomy **(12 marks).**

QUESTION THREE

Briefly explain the following phenomena;

A. Alveoli **(4 Marks)**
B. Formed elements of blood **(5 Marks)**
C. Keratinocyte **(4 Marks)**
D. Hormone **(4 Marks)**
E. Blood testis barrier **(3 Marks)**

SECTION B

QUESTION FOUR

A. Define exocrine glands and differentiate the types of exocrine glands by their methods of secretions, and for each type, give an example of the gland found in the body of an animal **(10 Marks)**

B. A sarcomere is the smallest functional unit of striated muscle tissue. It is composed of two main protein filaments which slide past each other during contraction. The model that best describes muscular contraction is called the **sliding filament theory**.

   i. Draw a simple sketch of a sarcomere, showing how the protein filaments are arranged and label the different regions **(5 Marks)**

   ii. Briefly explain the changes that occur to the different parts and regions of the sarcomere during muscle contraction **(5 Marks)**

QUESTION FIVE

A. Mention the two (02) subdivisions of the autonomic nervous system and clearly state circumstances under which they are activated. **(2 Marks)**

B. List any four (04) target organs and state the effects on the target organs **(8 Marks)**

C. List six (06) general roles that bones play in the body of an animal **(3 Marks)**.

D. Bones are classified into 4 groups based on the anatomical structure. List the four classes and each category, give an example of one bone that belongs to that 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 SIX

A. List and clearly differentiate the four (04) types of digestive systems found in farm animals. **(8 Marks)**

B. Give one example of one livestock species that belongs to each of the types in 'A' and state the main diet. **(4 Marks)**

C. Mention any two (02) accessory organs of the digestive system and clearly state their main role. **(4 Marks)**

D. The wall of the small intestine has four (04) layers of tissue, mention and state their functions. **(4 Marks)**

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

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

2022/23 Academic Year Final Examinations

AGA 4522: Rabbits and Dairy Production

Date: 10th November 2023 **Time:** 14:00 Hours

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Instructions: Answer any Five (5) questions, they all carry 20 equal Marks.

SECTION A: RABBITS AND DAIRY GOAT PRODUCTION

Question One

A farmer group from Lusaka East has just learned that rabbits are a cheap source of meat for rural households. Farmers have noted that rabbits are small, cheap to purchase and house. The initial capital to start a rabbit production enterprise is minimal because a rabbit hutch may be constructed with the use of scrap wood or bamboos. A rabbitry can also be established using a disused garage or pigsty. Prepare detailed notes on any other ten (10) reasons to convince this farmer group to establish rabbit units on their farms in Lusaka East **(20 marks)?**

Question Two

Milk is produced and stored in the dairy goat's udder. The dairy goat must be stimulated to let-down her milk. Answer the following:

a. What is milk ejection? **(05 marks)**
b. Explain in detail the physiology of milk ejection? **(10 marks)**
c. Why is it necessary to milk the goat quietly? **(05 marks)**

Question Three

A). Explain how you would manage young rabbits from birth to weaning including the key precautions that must be taken to ensure survival of the rabbits **(10 Marks)?**

B). Selected breeding is the process of choosing certain individuals to be parents of the next generation based on certain quality characteristics. Discuss some of the ideal quality characteristics that must be selected for on a dairy goat farm in Zambia **(10 marks)?**

SECTION B: DAIRY CATTLE PRODUCTION

Question Four

A). Name and explain at least three assisted animal reproduction techniques that you may wish to consider for enhancing productivity and reproductive performance of milk animals on smallholder farms and what are some of the limitations to successful implementation of the mentioned reproduction techniques in Zambia **(12 Marks)?**

B). How would you manage a herd of replacement heifers from weaning to three months of age including feeding and routine management practices that the animals may require for successful growth **(8 Marks)?**

Question Five

A). Explain why it is important to dry off a cow at least two months before calving and how would you prepare a cow for calving as it approaches it's due date **(8 Marks)?**

B). Explain the steps you may wish to undertake in order for you to produce good quality milk on the farm that is free from microbial, chemical and physical contaminations **(12 Marks)?**

Question Six

A). What are the main milk quality characteristics that can be tested on the farm and how would you go about in testing the milk for such characteristics **(8 Marks)?**

B). What is mastitis and how would you identify a cow that is having mastitis and what steps do you need to consider on the farm to minimize occurrence and spread of mastitis on the farm **(12 Marks)?**

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

END OF YEAR EXAMINATIONS

2022/23 ACADEMIC YEAR

AGC 2042: SUSTAINABLE CROP PRODUCTION

Time Allowed: Three hours **Total Marks: 100**

Instructions

1. You are required to answer all questions.
2. Write in a legible handwriting.
3. Marks are as indicated.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Question 1

Indicate True or False

1 mark each

a. Streak virus in Maize is transmitted by grass hoppers.
b. The safe moisture content for storage of Sunflower seed is 12%.
c. Allelopathic crops inhibit the growth of weeds in an organic field.
d. White varieties of Sorghum are used for malting.
e. Pumpkins are interplanted with Maize.
f. In organic farming, the seeds planted by farmers are hybrids.
g. Cotton seed is planted at a depth of 5 cm.
h. *Rhizobium japonicum* is the nitrogen fixing bacteria found on nodules on roots of the Soya bean plant.
i. Cuttings for planting Sweet Potato should be 20 cm to 25 cm in length with 5 to 7 nodes
j. Stem maggot is a pest which a Bean crop is susceptible to.
k. Leaf blight is a disease which a Rice crop is susceptible to.
l. Tyre cord is made from Cotton fabric.
m. Production of Cotton at altitudes of 1200 metres above sea level is not recommended because of high temperatures.
n. Green manure crops help in breaking the life cycle of pests and diseases.
o. Hedge rows provide a habitat for pests and predators.
p. Biological control of pests involves the use of farmers' friends.

16 marks

Question 2

a. Sweet potatoes are propagated using plant cuttings called_____.
1 mark

b. In Groundnuts, Calcium deficiency leads to aborted embryos called _____.
1 mark

c. In Groundnut production, what determines spacing in the field?
2 marks

d. Which pest cuts seedlings at soil level? **2 marks**

e. Give the common name of *Striga* species. **2 marks**

f. Name the family to which Groundnuts belong. **2 marks**

g. Indicate the spacing (inter row and intra row) used when making basins. **2 marks**

h. What is the main function of green manure crops? **2 marks**

i. Give the scientific name of the pest to which the Sorghum crop is susceptible at maturity.
4 marks

j. What is the scientific name for Rice. **4 marks**

k. Briefly explain how cereal grains are protected from the damage caused by storage pests.
4 marks

Question 3

a. Briefly explain how phyto-sanitation is practised in the field. **2 marks**
b. Name two (2) plants that are used in the preparation of leaf tea. **2 marks**
c. Briefly discuss the importance of leaf tea. **2 marks**
d. Briefly explain how teas in general are prepared. **4 marks**
e. Discuss crop rotation in an organic field. Give relevant examples. **10 marks**

Question 4

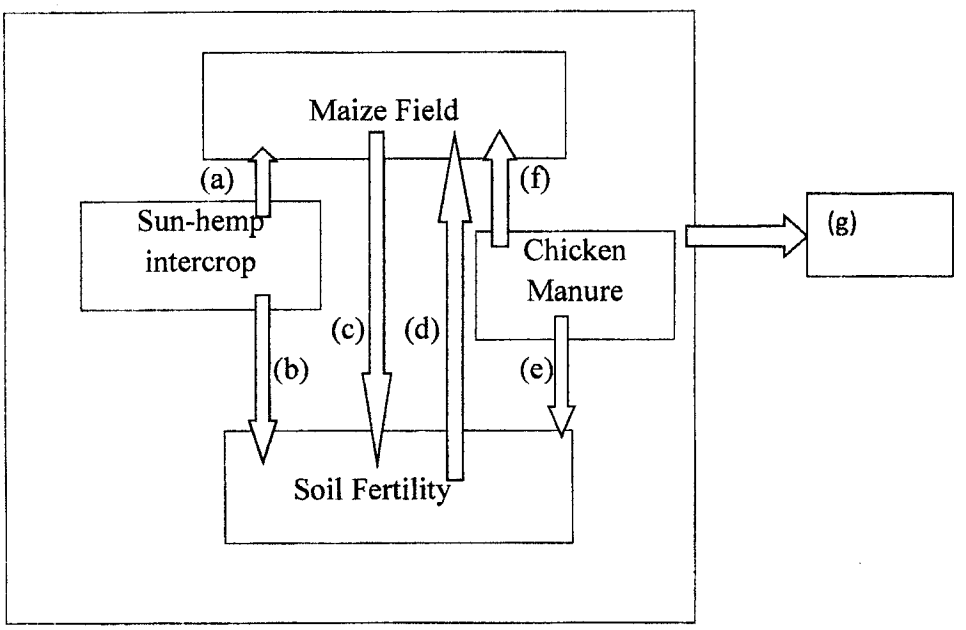
The emphasis in organic farming is on minimum disturbance of the soil when preparing the land for planting.

a. List the sustainable methods of land preparation. **4 marks**
b. For each named method, briefly explain what it entails. **12 marks**

Question 5

a. What does the word "Sustainability" mean? **2 marks**
b. Having defined Sustainability in 5a. above, describe what Sustainable Crop Production is. **4 marks**
c. Describe a farming system that was employed in Maize that was grown as a practice of sustainable Maize production. **5 marks**

d. Model depicting a Farming System is shown below.



In the Model above, letters (a) to (g) show that the farming system you employed was sustainable. Clearly relate and indicate each pathway to the following statements:

i. Enhance biological diversity within the whole system.
ii. Increase soil biological activity.
iii. Maintain long-term soil fertility.
iv. Recycle wastes of plant origin in order to return nutrients to the soil.
v. Increase soil Nitrogen.
vi. Supply plant nutrients to the crop.
vii. Improving soil structure and Fertility.

11 marks

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGA 4532: PIG AND POULTRY PRODUCTION

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has two sections, with three (3) questions in each section.
2. You are required to answer ANY five (5) questions from the six (6) provided
3. Write your answers to questions in each section in a separate answer booklet
4. Read each question carefully before tempting it.
5. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A - POULTRY PRODUCTION

QUESTION ONE

You have a poultry house measuring 6m wide and 12m long.

(a) What is the optimum number of broilers that you can keep in this house. (3 Marks)

(b) Based on your answer to (a) estimate the number of 50Kg bags of each of the following types of feed that is required, using the broiler management guide you have been provided with;

(i) Starter feed to be fed from 0 -21 days (3 Marks)

(ii) Grower feed to be fed from 22-29 days (3 Marks)

(iii) Finisher feed to be fed from 30-42 days (3 Marks)

(c) Assuming that the house mentioned (a) has a flat roof, and its height at all of its corners is 3.5m high, calculate the amount of Potassium permanganate and Formalin required to fumigate the house before placing the chicks (3 Marks)

(d) How much skimmed milk and water would be required to vaccinate the broiler chicks determined in (a) at 10 days of age? (5 Marks)

QUESTION TWO

(a) The Table labelled **(I)** below shows you results of birds that were sampled and weighed in a 1800 layer flock, while that one labelled **(II)** shows its production performance parameters. Using Table labelled **(I),** Calculate the uniformity of this flock (8 Marks)

(I)

Weight of the birds (g)	No. of birds
1600	x x
1550	x x x
1500	x x x x x
1450	x x x x x x
1400	x x x x x x x x
1350	x x x x x x x x x
1300	x x x x x x x x x x
1250	x x x x x x x x x x x
1200	x x x x x x x x x x x
1150	x x x x x x x x x x
1100	x x x x x x x x
1050	x x x x x x
1000	x x x x
950	x x x
900	x x

(II)

Day	Mortality (dead birds)	No. of eggs laid	Average egg weight (g)	Feed intake (g/bird/day)
Mon	0	1190	56	134
Tue	2	1199	58	137
Wed	0	1235	56	136
Thu	2	1240	57	138
Fri	0	1250	58	135
Sat	0	1288	55	136
Sun	2	1268	58	137

(b) Using Table labelled **(II),** calculate its;

(i) Feed conversion ratio (5 Marks)

(ii) Hen day egg production percentage for this flock (5 Marks)

(iii) Hen housed egg production percentage of the flock (2 Marks)

QUESTION THREE

(a) With three reasons, explain the importance of the following routine management tasks carried out when managing chickens;

(i) Provision of electrolyte to day old chicks (3 Marks)

(ii) Egg candling at 7 days of incubation (3 Marks)

(iii) Debeaking layer chicks during their rearing (3 Marks)

(b) Explain how some management factors affecting the breeding flock at the farm affect the production output of day-old chicks at the hatchery (10 Marks)

SECTION B -PIG PRODUCTION

QUESTION FOUR

(a) Briefly explain how you would prepare a pregnant sow for farrowing during the last two (02) weeks of her pregnancy. (3 Marks)

(b) Highlight the physical and behavioral features that a sow that is in the farrowing period exhibits (3 Marks)

(c) Briefly outline how to take care of newly born piglets in the first 24 hrs of life (2 Marks)

(d) High piglet mortality is a common problem small scale farmers face which tends to negatively affect profitability of the pig enterprise. List any five (05) common causes of piglet mortality (5 Marks)

(e) List four (04) ways piglet mortality can be prevented (4 Marks)

(f) Define the following terms

(i) Agalactia (1 Mark)

(ii) Repeat breeder (1 Mark)

(iii) Runt (1 Mark)

QUESTION FIVE

(a) Clearly differentiate 'flushing' and 'steaming up' in pig production by stating when, how and why they are done. (6 Marks)

(b) What is the recommended feeding allowance for the following categories of pigs?

(i) Lactating sow (1 Mark)

(ii) Mature boar (1 Mark)

(iii) Weaners - from day of weaning up-to 55kg (2 Marks)

(c) What is the most limiting amino acid in pig nutrition and state it's importance? (2 Marks)

(d) Differentiate the following terms;

(i) Pen mating and hand mating (1 mark)

(ii) Litter size and litter number (1 mark)

(iii) Estrus period and estrus cycle (1 mark)

(iv) Dry sow and empty sow (1 mark)

(e) When selecting pigs for breeding, besides looking for physical features, the history of the parent stock should also be taken into consideration. List any four (04) factors in the female parent stock that should be taken into consideration (2 marks)

(f) Record keeping is important in pig production. Design and title a simple record card. (2 Marks)

QUESTION SIX

Organic pork is a growing market in many countries. However, its production has many rules and regulations. A farmer who decides to go into organic pig production should know that the sector faces a lot of challenges, however benefits are also there.

(a) Define organic pig production (1 mark)

(b) Outline four (04) goals of organic pig production (4 marks)

(c) What type of housing system is suitable for organic pig production and list one advantage and disadvantage associated with such housing? (3 marks)

(d) Outline the four (04) preventive animal health husbandry practices (4 marks) which should be enforced in organic farming

(e) List five (05) challenges associated with organic pig farming (5 marks)

(f) List three (03) benefits of organic pig farming (3 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 3135: FUNDAMENTALS OF PLANT SCIENCE

Date: Thursday 9th November, 2022 Time: 09:00 –12: 000 HRS Venue: Omnia 1

Instructions:

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

Question 1. **(20 Marks)**

a) Define soil water potential. **(3 Marks)**

b) Define Agroforestry. **(3 Marks)**

How is food production likely to be negatively affected with increase in global temperature?

a) **(4 Marks)**

b) What is soil nutrient depletion? **(3 Marks)**

c) Describe two constraints faced by farmers in the economic, social and environmental areas. **(3 Marks)**

d) Briefly explain how these constraints can be overcome? **(4 Marks)**

Question 2 **(20 Marks)**

i) Briefly describe three methods for determining soil water content. **(4 Marks)**

ii) What are the underlying principles of the methods? **(4 Marks)**

iii) The soil water storage of a field was measured 61 days after planting using a Neutron Moisture scattering method and is given in Table 1. Given that the runoff was insignificant, calculate the change in soil water storage and evapotranspiration after 61 days. **(12 Marks)**

Table 1: Soil water storage of a field

DAP	3	10	17	24	31	40	46	54	61
S*	18.4	20	20.9	20.1	24.7	18.4	20.8	23.1	20.8
q**	-	0	0	0	0.06	-0.15	-0.07	0	0
I (cm)***	2	1.4	1.4	1.4	3	3	3	4.2	4.2
P (cm)***	0	0.4	0.9	2.8	4.9	6.4	8.8	8.8	10

DAP = Days after planting
S* = Storage (cm/100 cm of soil depth)
q** = Flux (cm/day). Drainage D = $\sum$qt (cm)
I (cm)*** and P (cm)*** = Cumulative values of irrigation and precipitation respectively of the indicated days after planting.

Question 3 **(20 Marks)**

i. What are the types of fertilizers in crop and plant production? **(2 Marks)**
ii. What Nutrient Solution System (without soil) can be used to produce high value crops such as Tomato or Lattice? **(4 Marks)**
iii. What was the advantages of the system you used in crop production compared to others to grow crops without soils. **(4 Marks)**

A study on Cowpea was carried out in nutrient solution system where all essential plant nutrients were added in the control nutrient solution. Nitrogen and Phosphorus were not added in the experimental nutrient solution. The results of the study are presented in Figure 1.

iv. Explain the results of the study. **(5 Marks)**
v. How could you use the results to improve crop production in the country? **(5 Marks)**

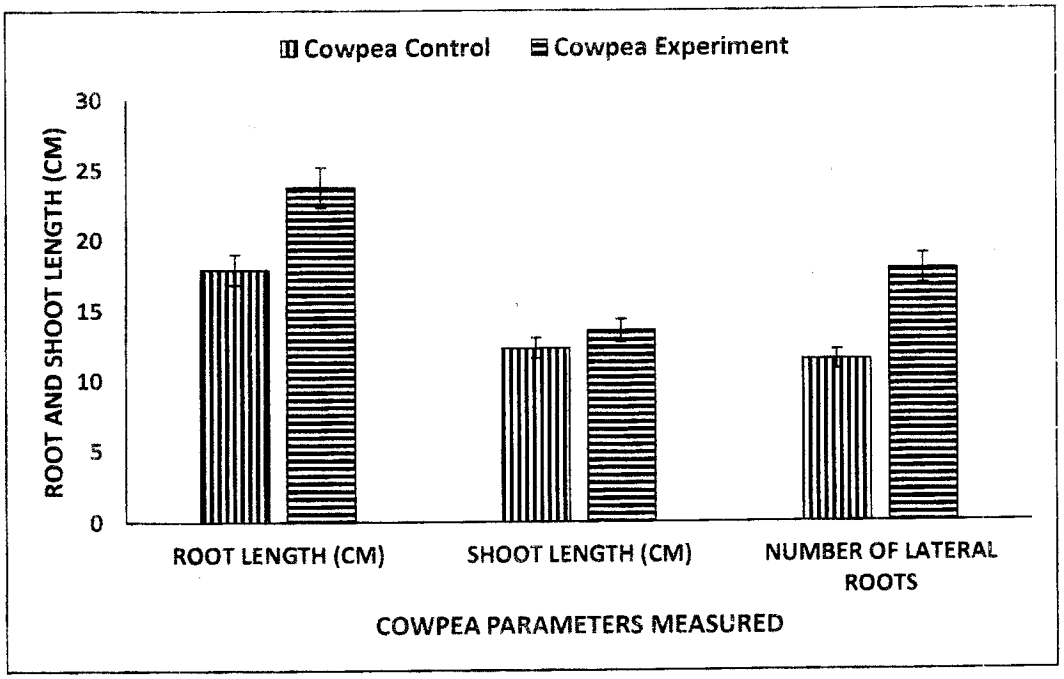


Figure 1: Effect of N and P on the growth and performance of Cowpea in plant nutrient

Question 4 **(20 Marks)**

i) What is Photosynthesis? **(2 Marks)**
ii) Explain the significance of the wavelength of light on absorbance by chlorophyll in photosynthesis as depicted in Figure 2.

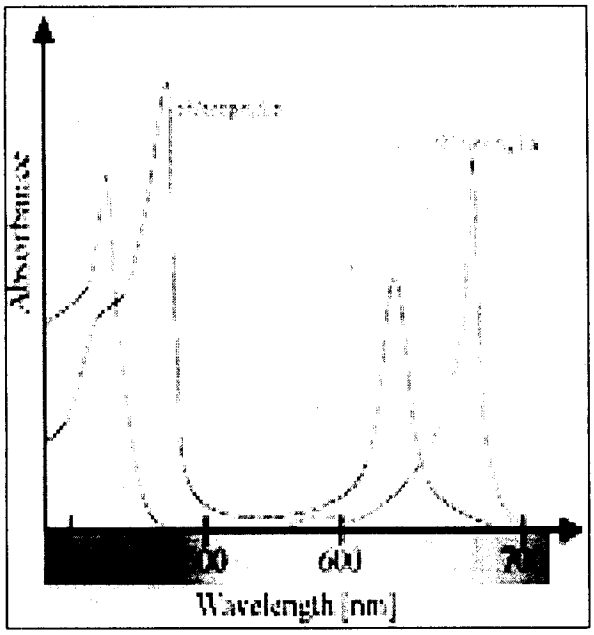


Figure 2: Absorbance of wavelength of light by chlorophyll

iii) Describe the light dependent and light independent reactions in Photosynthesis. **(4 Marks)**
iv) What are the distinguishing features of C_3 and CAM plants? **(4 Marks)**
v) How is Photosynthesis responsible for life on plsanet Earth? **(5 Marks)**

Question 5

i) What is Tissue Culture? **(3 Marks)**
ii) What is Totipotency? **(3 Marks)**
iii) What are the common constitutes of Plant Growth Media **(3 Marks)**
iv) What are the stages of Plant Tissue Culture **(5 Marks)**
v) Why are Scientists broadening their perspectives to utilize Tissue Culture in all the spheres of Agriculture? **(6 Marks)**

END OF EXAM

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGC 3412: INTRODUCTORY HORTICULTURE

Time Allowed: Three hours **Total Marks: 100**

Instructions

1. You are required to answer all questions.
2. Write in a legible handwriting.

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Question 1

Indicate True or False

1 mark each

a. Movement of air/wind over the leaf tends to remove water vapour and reduces transpiration.
b. In plants, growth occurs only when anabolism exceeds catabolism.
c. The recommended pH for the vase solution of cut flowers is 4.
d. Manure tea is the liquid fertilizer applied as top dressing.
e. Comfrey roots can penetrate into the soil up to a depth of three (3) metres.
f. Blossom end rot of Tomato is caused by a deficiency of Phosphorous in the soil.
g. Translocation is the movement of water, minerals and food from one part of the plant to another.
h. Essential oils are extracted from *Eucalyptus citronella.*

Question 2

a. Name the substance that comes out from the wound when Banana hands are cut from the bunch. **1 mark**
b. When handling cut flowers, purafil pads are hung in cold rooms to absorb _____. **1 mark**
c. _____ is the process of removing field heat from the harvested products. **1 mark**
d. Name the most important plastid. **1mark**
e. In which part of the cell does photosynthesis take place? **1 mark**
f. From your answer in 2d., what pigments does the named plastid contain? **2 marks**
g. Define the term "bud." **2 marks**
h. List the different types of buds that are found on plants. **5 marks**
i. From the named buds in 2e., choose one (1) that is significant in Tomato and Amaranth production. Give a short description of the named bud. **2 marks**
j. Briefly explain the significance of the named bud in the following:
    i. Tomato production. **2 marks**
    ii. Amaranth production. **2 marks**
k. When handling cut flowers, the vase solution will not be taken up by cut stems due to blockage. List the causes of this blockage. **3 marks**
l. As a Packinghouse Manager, what measures would you institute in order to prevent the blockage referred to in 2h.? **3 marks**

Question 3

A farmer engaged in mixed cropping is about to harvest her crops.

a. Name the implement that will be used during harvesting of the following crops:
    i. Roses. **1 mark**
    ii. Oranges. **1 mark**
    iii. Bananas **1 mark**

b. What is the maturity index of the following crops based upon?
   i. Flowers. **1 mark**
   ii. Melons. **1 mark**
   iii. Bananas. **1 mark**
   iv. Cauliflower. **1 mark**

c. In organic farming, name the practice that assists natural predators to survive on the farm. **2 mark**
d. Name the root that is found at sites other than the site of the primary root. **2 marks**
e. Give the main reason why root and tuber vegetables e.g. Carrots and Irish Potatoes, are waxed and this is exclusive to such products. **2 marks**
f. What does Controlled Atmosphere storage involve? **4 marks**
g. After bunching, the flower buds on Roses are protected by _____ while those on Gladiolus are protected by _____. **4 marks**
h. Explain how Stalk borers (*Busseola fusca*) are managed in an organic Green Maize crop. **6 marks**

Question 4

a. Horticulture is a wide discipline.
   i. Mention a discipline of horticulture that you practiced in AGC 3412 at the field station. **2 marks**
   ii. Mention the variety of the one (1) horticultural crop that was grown and managed in your practice in AGC 3412. **2 marks**

b. In Onion production, spacing has a relationship with bulb size.
   i. Briefly describe the relationship between spacing and required bulb size. **4 marks**
   ii. Briefly describe an environmental parameter that favours bulb formation. **2 marks**
   iii. What spacing was recommended in the production of Onion that you grew at the field station? **2 marks**
   iv. In answering (biii), indicate the size of bulbs to be expected at harvest time. **2 marks**

Question 5

a. Onion is a cool season crop.
   i. What does the statement above imply? **2 marks**
   ii. How do low temperatures impact the growth of the crop? **2 marks**
   iii. What does the term '**Hardening**' of seedlings mean? **2 marks**
   iv. How does one proceed to harden Onion seedlings raised on a nursery? Mention only two (2) parameters. **2 marks**
b. Composting of farm residues has always been carried out in a traditional way. As a University of Zambia graduate in the School of Agricultural Sciences, you are hired to

train a group of farmers on a fairly new method of composting known as Bokashi making. For the benefit of the farmers:

i. In a sentence, explain what Bokashi fertilizer is. **2 marks**

ii. State two (2) advantages of using Bokashi fertilizer. **2 marks**

iii. List nine (9) ingredients needed for Bokashi making. **9 marks**

iv. Describe two distinguishing characteristics between Bokashi and the traditional compost. **4 marks**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGE 2122: FUNDAMENTALS OF MACROECONOMICS

Time Allowed: Three hours. **Total Marks: 100**

Instructions:

1. The examination paper has two sections.
2. Sections A is **compulsory**
3. Section B has three questions. Answer **ANY TWO** questions in **Section B**
4. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A: [40 marks]

Instructions:

- There are 20 questions, comprising multiple choice and short answer questions. Answer **ALL**.
- Each correct response carries 2 marks
- Write either **True or False or short answers in the provided Answer Booklet.**

Question 1: Intermediate goods are **NOT** included in the calculation of GDP. **[2 marks]**
A. True **B**. False

Question 2: GDP includes the value of all final goods and services, regardless of where the production occurred or where the services were provided. **[2 marks]** **A**. True **B**. False

Question 3: Suppose that a country has 9 million people working full-time. It also has 1 million peopl who are actively seeking work but are currently unemployed, along with 2 million discouraged worker who have given up looking for work and are currently unemployed. What is this country' unemployment rate? **[2 marks]**

A. 10 per cent **B**. 15 per cent **C.** 20 per cent **D**.25 per cent

Question 4: If consumption of a certain good is higher than production, the change in private inventories for the period will be negative. **[2 marks]** **A**. True **B.** False

Question 5: Which of the following statements is accurate about the two-sector economy? [2 marks]

A. The two-sector economy consists of firms and the government
B. The two-sector economy consists of firms and foreign sector
C. The two-sector economy consists of households and government
D. The two-sector economy consists of households and firms

Question 6: Excessive borrowing by the government from the domestic money market may lead to an outcome called _____

A. Sustainable debt position
B. Fiscal policy
C. Crowding-out effect of the private sector
D. None of the above

Question 7: Which of the following measures are adopted to take care of inflation in an economy? [2 marks]

A. Decrease in transfer payments along with a reduction in taxation
B. Increase in transfer payments along with an increase in taxation

C. Decrease in government expenditure along with an increase in taxation
D. Increase in government expenditure along with a decrease in taxation

Question 8: Which of the following methods must be adopted to tackle the problem of recession within an economy? [2 marks]

A. Increase the public borrowing and reduce taxation
B. Reduce the public borrowing and increase taxation
C. Reduce the spending on government welfare projects and increase taxation
D. Increase the spending on government welfare projects and reduce taxation

Question 9: Which of the following statements are true about the study of macroeconomics? [2 marks]

A. It is a study of economics that deals with households, government, firms and demand-supply
B. It is a study of economics that deals with households, government, firms and the extern sector
C. It is a study of economics that deals with price levels, profit, expenditure and cost
D. None of the above

Question 10: Which of the following statements reflects the true meaning of gross investment? [2 marks]

A. Gross investment is the total of net investment and depreciation
B. Gross investment is the difference between the net investment and depreciation
C. Both a and b are correct
D. Both a and b are incorrect

Question 11: The _____ _____ of calculating GDP adds up the total factor income earned b households by way of labor, the interest income earned by lenders, the rent earned by renters of land ar buildings, and the profit earned by shareholders, as paid by firms in the economy. **[2 marks]**

Question 12: In the circular flow model, the two markets are _____markets and _____markets. **marks]**

Question 13: _____GDP is a better indicator of current production level.**A**. Real B. Nominal **marks]**

Question 14: What is the formula for calculating real GDP per capita? _____ **marks]**

Question 15:GDP adjusted for inflation is called_____**[2 marks]**

Question 16: The government should run significant budget _____ during economic downturns and ru budget _____ while the economy is booming. **[2 marks]**

A. Surpluses; deficits **B**. Deficits; surpluses **C**. Surpluses; surpluses **D**. Deficits; deficits

Question 17: The exchange rate between the U.S. dollar and the Zambian Kwacha starts at $1 = ZMW 20. It then changes to $1 = ZMW 21.5. Given this change, the U.S. dollar has _____ while the Zambian Kwacha has _____. **[2 marks]**

A. depreciated; appreciated
B. appreciated; depreciated
C. depreciated; depreciated
D. appreciated; appreciated

Question 18: Demand-pull inflation may be caused by:**[2 marks]**

A. An increase in production costs
B. Reduction in the standard of living
C. Reduction in the price of products
D. Reduction in the purchasing power of Kwacha

Question 19: When money works as a common denominator into which the values of all goods and services are expressed, it is which function of money? **[2 marks]**

A. Unit of account
B. Medium of exchange
C. Standard of deferred payment
D. Store of value

Question 20: Which of the following is the best example of an automatic stabilizer in fiscal policy?**[2 marks]**

A. Spending more on national highways
B. Paying pensions to retired public service personnel
C. Paying unemployment insurance benefits
D. Decreasing the supply of money

Section B [60 marks]

- There are 3 questions in this Section and each question carries 30 marks.
- Answer **ANY TWO (2)** questions

Question 21: [30 marks]

a) What are the main components of measuring GDP with what is demanded? **[5 marks]**
b) What is the difference between a series of economic data over time measured in nominal terms versus the same data series over time measured in real terms? **[2 marks]**
c) What is a market basket or basket of goods? **[3 marks]**
d) What is the CPI and how is it calculated? **[6 marks]**
e) Define Investment spending and explain three categories of investment spending? **[8 marks]**
f) What is an Exchange rate and explain how exchange rate fluctuations (appreciation and depreciation) affect international trade **[6 marks]**

Question 22: [30 marks]

a) Given the following data, Autonomous consumption = ZMW 500; Marginal propensity to save =0.2; investment = 2,000, calculate the:
   (i) Marginal propensity to consume **[2 marks]**
   (ii) Equilibrium level of national income: **[4 marks]**
b) Explain what Unemployment rate is and how it is calculated. **[6 marks]**
c) Explain what natural unemployment is. **[2 marks]**
d) Outline at least **two** reasons why unemployment is a macroeconomic concern to society? **[4 marks]**

e) Briefly explain the following statements:
   (i) Frictional unemployment is higher when the pace of technological advance quickens.**[4 marks]**
   (ii) Structural unemployment is higher when the pace of technological advances quickens.**[4 marks]**
   (iii) Frictional unemployment accounts for a larger share of total unemployment when the unemployment rate is low.**[4 marks]**

Question 23: [30 marks]

a) Brief explain the following terms:
   (i) Tight monetary policy. **[4 marks]**
   (ii) Contractionary fiscal policy. **[3 marks]**
   (iii) Money creation by commercial banks **[3 marks]**
   (iv) Open market operations **[3 marks]**
b) Explain what a recessionary gap is and outline **at least two** indicators that would be prevalent in an economy experiencing a recessionary gap.**[6 marks]**
c) Clearly explain the appropriate economic policy you would recommend to remedy the situation in (b). **[7marks]**
d) What type of budget would such a government be running and why is it called that name? **[4marks]**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGE 3042: INTERMEDIATE MACROECONOMICS

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. This examination paper has two sections. Section A has five (4) standalone questions and Section B has two (2) questions with parts.
2. Read all the questions carefully and answer all questions in both sections.
3. Points for each question are shown in parenthesis. Therefore, allocate your time appropriately.
4. Please be concise when answering the questions and write legibly.
5. Show all your work on quantitative questions to earn you partial credit.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A [40 MARKS]

A1. Describe the steps taken to compute the year-on-year inflation rate of a country using the consumer price index method. **[8 marks]**

A2. You are the economic advisor to President Hakainde Hichilema. He would like to know the relationship between inflation and nominal interest rates. Using the relevant theory, explain the relationship between the two variables and state the likely effect of high inflation rates on the ability of emergent farmers to borrow to enhance Zambia's agricultural production. **[8 marks]**

A3. One of the key determinants of economic growth based on the Solow growth model is the savings rate of a country. With the aid of a well labelled Solow model diagram, describe the effects of a reduction in the savings rate on a country's steady state level of the following: (i) investment per worker, (ii) capital per worker, and (iii) output per worker. **[12 marks]**

A4. Suppose the Zambian government decides to increase spending and the Bank of Zambia responds by deciding to hold real interest rates constant. With the aid of a well labelled IS-LM model diagram, explain the effects of the two policies on the following: (i) IS curve, (ii) LM curve, (iii) real interest rate, and (iv) the country's national output (GDP). **[12 marks]**

SECTION B [60 MARKS]

B1. Consider a consumer with the following utility function:

$$U(C_1, C_2) = C_1 C_2$$

where C_1 is consumption in period 1 and C_2 is consumption in period 2. The consumer's income in period 1 is 500, income in period 2 is 200 and the real interest rate is 10%. Using the Irving Fisher and intertemporal budget model, answer the following questions:

a. Derive the consumer's intertemporal budget constraint based on the information provided. **[3 marks]**

b. Set up the consumer's utility maximization problem and compute the optimal choice of consumption in period 1 and 2. **[8 marks]**

c. Draw a well-labelled graph showing the intertemporal budget constraint (label it IBC1), the indifference curve tangent with IBC1. Please ensure to label the optimal choice bundle and the axes points for IBC1. **[4 marks]**

d. Suppose income in period 2 rises to 500 while the interest rate and income in period 1 do not change, what will be the optimal choice of consumption in period 1 and 2? **[9 marks]**

e. Draw a well-labelled graph showing the intertemporal budget constraint before period 2 income change (IBC1), the intertemporal budget constraint after period 2 income change (IBC2), and the indifference curve tangent with IBC2. Please ensure to label the new optimal choice bundle and the axes points for IBC1 and IBC2. **[6 marks]**

B2. Consider an economy with the following Cobb-Douglas production function:

$$Y = 200K^{0.4}L^{0.6}$$

a. Derive the per worker production function. **[4 marks]**

b. Assuming the economy's saving rate is set at 20% and the rate of depreciation of capital is 5%. Compute the following in the steady state:

   i. Capital per worker **[4 marks]**

   ii. Output per worker **[2 marks]**

   iii. Consumption per worker **[3 marks]**

c. Suppose the government in this economy wants to maximize consumption.

   i. Set up the golden rule steady state consumption maximization problem and derive the necessary condition for consumption optimization **[5 marks]**

   ii. Assuming the depreciation rate of capital is still at 5%, compute the following golden rule steady state conditions:

      1. Capital per worker **[4 marks]**

      2. Output per worker **[2 marks]**

      3. Consumption per worker **[3 marks]**

d. Compare the consumption per worker between the steady state (in part b) and the golden rule steady state (in part c). What conclusion can you draw based on your findings? **[3 marks]**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGE 3322: INTERMEDIATE MATHEMATICS FOR ECONOMICS

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has two sections.
2. Section A is compulsory, and it has two questions. Answer both questions in section A.
3. Section B has three questions. Answer question three and any one of the remaining two questions in section B.
4. You are required to answer a total of four (4) questions in this exam.
5. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A

Question One **[30 marks]**

Given a Markov chain with the following transition matrix:

$$P = \begin{bmatrix} 0.7 & 0.2 & 0.1 \\ 0.3 & 0.4 & 0.3 \\ 0.2 & 0.3 & 0.5 \end{bmatrix}$$

a) (20 marks) If the initial state distribution is [0.5, 0.3, 0.2], compute the state distribution after two transitions.

b) (10 marks) Determine the steady state distribution.

Question Two **[20 marks]**

An economy has three sectors: Agriculture (A), Manufacturing (M), and Services (S). The input-output table shows the following inter-sectoral flows: A to M = $20 million, M to S = $30 million, S to A = $10 million. Additionally, the final demand for A is $40 million, for M is $50 million, and for S is $60 million. Calculate the total output for each sector.

Section B

Question Three **[30 marks]**

a) (20 marks) In a simple CGE model, there are two goods: Bread (BRD) and Milk (MLK), and two factors: Capital (CAP) and Labor (LAB). The price of Bread is $2, and the price of Milk is $3. The household has an endowment of 10 units of Capital and 15 units of Labor. The income from Capital is $50, and from Labor is $75. Calculate the household's total income and determine how much of each good (Bread and Milk) the household can consume if it spends its entire income on these goods.

b) (10 marks) Assume a production function for Bread (BRD) where the output is a function of Capital (CAP) and Labor (LAB). If the production function is given by BRD = 2 * CAP + 3 * LAB, and the firm has 20 units of Capital and 30 units of Labor, calculate the total output of Bread.

Question Four **[20 marks]**

Given the utility function U = 2 * BRD + 3 * MLK, where BRD and MLK are quantities of Bread and Milk respectively, and the prices are $2 for Bread and $3 for Milk. If the household's budget is $120, determine the optimal quantities of Bread and Milk the household should consume to maximize utility.

Question Five **[20 marks]**

Consider a simple SAM with two activities (A1 and A2), two factors (F1 and F2), and one household (HH). The transactions are as follows: A1 to F1 = $20, A1 to HH = $30, A2 to F2 = $40, A2 to HH = $50. Calculate the total output for each activity and the total income for the household.

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGE 4142: AGRICULTURAL MARKETING AND PRICING

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. Answer ALL the questions in Section A and B.
2. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A

Question One

For each of the following, indicate whether the statement is TRUE or FALSE **and** write a one sentence justification for your answer. **[20 Marks]**

a) Short-run aggregate supply in agriculture is highly price elastic.

b) A producer can always increase total revenue by increasing the price of the commodity.

c) A firm will always set its product's price equal the market clearing price.

d) Supply is price-elastic for a particular commodity when alternative uses for resources are available.

e) An increase in the price of one product can cause the supply curve of another product to shift to the right.

f) An industry is considered vertically integrated only if successive stages of marketing and processing or marketing and production are linked together through ownership.

g) All producers shipping homogenous units of the same commodity to a single central market will receive the same net price.

h) An anthrax attack in livestock in one year can lead to seasonal price variations.

i) The effectiveness of a particular marketing board can be viewed in terms of generation of producer-oriented monopoly power.

j) The length of a production cycle is the vertical distance from trough to peak.

Section B

Question Two

Briefly explain four (4) unique characteristics of agricultural product markets. [8 Marks]

Question Three

With the aid of a clearly labeled graph,

a) Explain how a firm under a monopoly market structure will determine its product's profit maximizing output and price.
b) How do the price and output determined in (a) compare with what the firm would set if it was operating in a competitive market instead.

[12 Marks]

Question Four

Briefly explain how farmers' soya beans storage decisions can affect current and future soya beans prices. [4 Marks]

Question Five

Illustrate the effect of the following on the supply of beef:

a) An increase in the market price of soya beans used in feed production.
b) An increase in the price of beef.
c) A reduction in the price of pork.
d) An increase in leather prices.

[8 Marks]

Question Six

A group of pepper farmers in Chisamba is considering forming a marketing cooperative to sell their peppers to restaurants and hotels in Lusaka.

a) Briefly explain two (2) options for selling arrangements between the farmers and the cooperative to be considered.

b) Mention three (3) potential issues of collective bargaining as a price discovery that may affect the cooperatives effectiveness.

[6 Marks]

Question Seven

Given that the retail price of pork chops is K119 per kilogram, the farm gate price of a pig is K60.00 per kilogram and a 350kg pig yields 150kgs of pork chops,

a) Calculate and interpret the farm-retail price spread,
b) Calculate and interpret the farm value as a percentage of the retail price.

[8 Marks]

Question Eight

Suppose there are only two markets for tomatoes in Lusaka, Bauleni and Soweto markets, located 8km apart. Given that the price is K50 per box at Bauleni market compared to k100 per box at Soweto market;

a) Illustrate how equilibrium can be achieved if trade is allowed between the markets and transfer costs are zero.
b) Who will benefit from trade? Explain your answer.
c) Under what condition(s) would the price difference persist even if trade is allowed to take place?

[20 Marks]

Question Nine

The following equation reports the regression results for bread demand analysis for Lusaka province over the past 60 years:

$$Q_t = 184.3 - 1.057P_{1t} - 0.384P_{2t} + 0.013I_{1t} + 1.812Y_t$$

where Q_t is the quantity of bread demanded, P_{1t} is the price of bread P_{2t} is the price of sweet potatoes, I_t is income and Y_t is the size of the population,

a) If $P_{1t} = 1$ and $Q_t = 4$
    i. Calculate the own-price elasticity of demand for bread

ii. Price flexibility coefficient for bread

iii. Total elasticity for bread given that the price of sweet potatoes increases by 0.3% given a 1% increase in the price of bread.

b) Is bread a normal or inferior good for consumers in Lusaka province? Justify your answer.

c) What is the relationship between sweet potatoes and bread for consumers in Lusaka province? Justify your answer.

[14 Marks]

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGE 4222: INTERMEDIATE AGRIBUSINESS MANAGEMENT

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. Answer all the questions
2. Write in a legible handwriting.

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Question One [15 marks]

a. Agribusinesses often provide both goods and services to their customers. Analyse the key distinctions between the production of physical goods and the delivery of services within the context of agribusiness. (7 Marks)

b. Discuss the implications for agribusiness managers and how they should adapt their operations management systems to efficiently handle both goods and services. Provide real-world/ specific examples to support your analysis. (8 Marks)

Question Two [15 marks]

Research suggests that when net profits in agribusiness represent 5% of sales, a 1% reduction in purchasing costs leads to a substantial 20% increase in profits compared to their previous level. Explore and discuss five factors that can significantly improve efficiency in the purchasing process within agribusiness.

Question Three [20 marks]

Discuss the 4Ps of marketing - product, price, place, and promotion and how they contribute to the overall agribusiness's success in the market in terms of strategies, target market and competitive positioning.

Question Four [20 marks]

Explain the fundamental components that constitute the foundation (building blocks) of successful entrepreneurship.

Question Five [30 marks]

The Business Model Canvas (BMC) is a lean start-up strategic management tool for developing or documenting business models.

a. Explain the main purpose and core elements of the BMC. (10 Marks)

b. Elaborate on how to effectively fill in the BMC template and provide real-world examples to illustrate your points. (20 Marks).

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGE 4322: APPLIED ECONOMETRICS

Time Allowed: Three hours. **Total Marks: 100**

INSTRUCTIONS (READ!!!!!)

1. This examination paper has two sections, Section A and B. Answer all the FOUR questions in both sections.
2. Answer Section A in one answer booklet and Section B in another answer booklet and tie them SEPARATELY.
3. At the end of the examination, ensure to indicate on the cover page, the section answered in each booklet.
4. Points for each question are shown in parenthesis. Therefore, allocate your time appropriately.
5. Please be concise when answering the questions and write legibly.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A

Question 1 [50 marks]

You are part of an international consulting team hired to assess the U.S. government's Medicare Programme. You have data to analyse medical expenditures of senior citizens (65 years and older) who qualify for health care under this programme. The Stata dataset for this analysis is **mus03data2.dta.**

a) Suppose you generate Table 1 to explore **mus03data2.dta.**

Table 1: List of variables

Variable	Obs	Unique	Mean	Min	Max	Label
dupersid	3064	3064	6.24e+07	2.00e+07	9.83e+07	Subject ID
age	3064	26	74.17167	65	90	Age
famsze	3064	10	1.907963	1	13	Size of the family
educyr	3064	18	11.77546	0	17	Years of education
totexp	3064	2599	7030.889	0	125610	total medical expenditure in US Dollars
private	3064	2	.5812663	0	1	=1 if private supplementary insurance
female	3064	2	.5796345	0	1	=1 if respondent is female
marry	3064	2	.5558094	0	1	=1 if married
phylim	3064	2	.4255875	0	1	=1 if respondent has functional limitation
actlim	3064	2	.2836162	0	1	=1 if respondent has activity limitation
income	3064	2108	22.47472	-1	312.46	annual household income in thousand US Dollars
totchr	3064	8	1.754243	0	7	number of chronic problems
suppins	3064	2	.5812663	0	1	=1 if respondent has supplementary private insurance

i. Write down the Stata command and option used to generate Table 1. **[1 mark]**

ii. Which variable is the key identifying variable? **[1 mark]**

iii. What information is captured under the column "unique"? **[2 mark]**

iv. What is the range for the variable **age**? Interpret this range. **[2 marks]**

v. What proportion of the sample are not married? **[1 mark]**

vi. What proportion of the sample have a functional limitation? **[1 mark]**

vii. What is the probable reason for why the minimum for the variable **income** takes a negative value? **[2 marks]**

b) Next, you generate Table 2 to get summary statistics for the variable **totexp** disaggregated by the variable **female**.

Table 3: Summary statistics for total medical expenditure by sex

-> female = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
totexp	1,288	7452.212	12617.56	0	108256

-> female = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
totexp	1,776	6725.336	11259.44	0	125610

i. Write down the Stata command used to generate Table 2. **[1 mark]**

ii. Who typically spends more on medical expenses between male and female senior citizens? Explain. **[2 marks]**

iii. Interpret the standard deviation of total medical expenditure for male senior citizens relative to that for female senior citizens. **[2 marks]**

c) Suppose you generate Figure 1 to check if there is a quadratic relationship between **totexp** and **age**.

Figure 1: Relationship between totexp and age

i. Write down the Stata command used to generate Figure 1. **[1 mark]**

ii. Based on the output in Figure 1, describe the relationship between **totexp** and **age.** **[3 marks]**

d) Suppose you regress **totexp** on **actlim** and generate the reporting table suitable for Microsoft Word (Table 4).

Table 4: Simple linear regression results of total medical expenditure

VARIABLES	OLS estimates
actlim	6,673***
	(459.6)
Constant	5,138***
	(244.7)
Observations	3,064
R-squared	0.064

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

i. Write down the Stata command used to generate results for the simple linear regression reported in Table 4. **[1 mark]**

ii. Write down the Stata command used to generate the Microsoft Word ready Table 4. The file is saved as myreg1.doc on your computer. **[1 mark]**

iii. State and interpret the goodness of fit of this regression. **[2 marks]**

iv. Interpret the intercept in Table 4. **[2 marks]**

v. Does actlim influence totexp? State the null and the alternative hypothesis at 1 percent level of significance. **[3 marks]**

vi. State and interpret the magnitude of the effect of actlim on totexp. **[2 marks]**

e) Suppose you transform the variable **totexp** to **ltotexp** using logs. Further, you estimate a log-level model with **ltotexp** as the dependent variable. Results are reported in Table 5:

Table 5: Log-level regression results of total medical expenditure (model 1)

VARIABLES	OLS estimates
age	0.00380
	(0.00366)
female	-0.0843*
	(0.0455)
income	0.00255**
	(0.00102)
suppins	0.256***
	(0.0462)
phylim	0.302***
	(0.0570)
actlim	0.356***
	(0.0621)
totchr	0.376***
	(0.0184)
Constant	6.704***
	(0.277)
Observations	2,955
F Statistic	124.98***
R-squared	0.229
Adj. R-squared	0.227

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

i. Write down the Stata command used to transform the dependent variable **totexp** to **ltotexp** using logs. **[1 mark]**

ii. Suppose you want to test whether having a functional limitation has the same effect as having an activity limitation. What is the name given to this test? State the null and alternative hypothesis for the test and write the Stata command you would use to implement this test. **[4 marks]**

iii. Briefly explain the effect of each independent variable that is statistically significant at 1 percent level of significance based on the results reported in Table 5. **[8 marks]**

iv. Using the results reported in Table 6, is there a problem of multicollinearity in our multiple linear regression reported in Table 5. **[3 marks]**

Table 6: Multicollinearity test results

Variable	VIF	1/VIF
phylim	1.63	0.612872
actlim	1.62	0.618416
totchr	1.16	0.860297
age	1.11	0.900535
income	1.09	0.921201
suppins	1.06	0.947491
female	1.03	0.970835
Mean VIF	1.24	

v. Suppose you add a quadratic term for **age**, would the inclusion of the term be justified based on the regression results in Table 7. **[4 marks]**

Table 7: Log-level regression results of total medical expenditure (model 2)

VARIABLES	OLS estimates
age	0.283***
	(0.0884)
c.age#c.age	-0.00186***
	(0.000588)
female	-0.0786*
	(0.0455)
income	0.00273***
	(0.00102)
suppins	0.264***
	(0.0462)
phylim	0.305***
	(0.0569)
actlim	0.372***
	(0.0622)
totchr	0.372***
	(0.0184)
Constant	-3.707
	(3.308)
Observations	2,955
F-statistic	110.94***
R-squared	0.232
Adj. R-squared	0.229

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

SECTION B

Question 2 [25 marks]

Suppose you are interested in explaining variations in household income using econometrics and the variables *hincome* (the household head's income), *hedu* (head's education level in years), *hage* (head's age), *children* (number of children), and *hsize* (household size). You run an ordinary least squares (OLS) regression in Stata and get the following results:

Source	SS	df	MS	Number of obs	=	7,934
				F(4, 7929)	=	105.33
Model	1.9423e+12	4	4.8558e+11	Prob > F	=	0.0000
Residual	3.6552e+13	7,929	4.6099e+09	R-squared	=	0.0505
				Adj R-squared	=	0.0500
Total	3.8495e+13	7,933	4.8525e+09	Root MSE	=	67897

hincome	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
heduc	3709.081	211.2186	17.56	0.000	3295.037	4123.125
hage	43.48789	55.82532	0.78	0.436	-65.94443	152.9202
children	-8380.815	2976.68	-2.82	0.005	-14215.89	-2545.738
hsize	2432.54	314.387	7.74	0.000	1816.258	3048.821
_cons	-10607.19	4495.165	-2.36	0.018	-19418.89	-1795.481

a) Write the econometric model **and** Stata command(s) corresponding to these regression results. **[4 marks]**

b) Suppose you suspect that *children* may be endogenous in this regression,

i) Explain what this means.

ii) What are the consequences of estimating with OLS if *children* is endogenous?

iii) What test can you use to check if *children* is endogenous?

iv) Write down the econometric equation and corresponding hypotheses of the test in part (iii).

[16 marks]

c)

i) Briefly explain a procedure you can use to estimate the effect of head's education on household income if *children* is endogenous.

ii) Write the Stata command(s) for the procedure in c(i).

[5 marks]

Question 3 [16 marks]

A researcher is estimating the response of maize yields to fertilizer in Zambia using the following econometric model and the data file **maize19.dta**:

$$Yield_i = \beta_1 + \beta_2 fertused_i + \beta_3 lime\_use_i + \beta_4 manure\_use_i + e_i$$

where $fertused$ is quantity of fertilizer used in kgs, $lime\_use$ and $manure\_use$ are dummy variables for lime and manure use respectively, each equal to 1 if the farmer used any and 0 otherwise.

a) Outline the test procedure you can use to test if the variance of the error term for manure users is different from non-manure users clearly stating the hypotheses, test statistic(s) and decision rule. **[8 marks]**

b) Write the Stata command(s) to perform the following tasks:

i. Test for heteroskedasticity due to the variable $farmsize$.

ii. Perform Generalized Least Squares (GLS) regression if var(e_i) = $\sigma_i = \sigma^2 farmsize_i$.

[8 marks]

Question 4 [9 marks]

Researcher Mulenga would like to explain maize price behavior using a dataset price.dta containing two variables *year* and *price* (annual maize price). Write the Stata commands to perform the following tasks:

a) List the variable *price,* its second order lag and its first difference for the first 30 observations. **[2 marks]**

b) Generate a time series plot of *price.* **[2 marks]**

c) Run the regression below using the variable *year* as the time variable.

$$price_t = \alpha_1 + \alpha_2 price_{t-1} + \alpha_3 price_{t-2} + e_t$$

[5 marks]

---The End--

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

2022/23 ACADEMIC YEAR FINAL EXAMINATIONS

AGF 2262
FUNDAMENTALS OF ENGINEERING DRAWING

Date: 16TH NOVEMBER 2023

Time: 09:00 - 12:00 HRS **Venue: TBA**

Duration: Three (3) HOURS

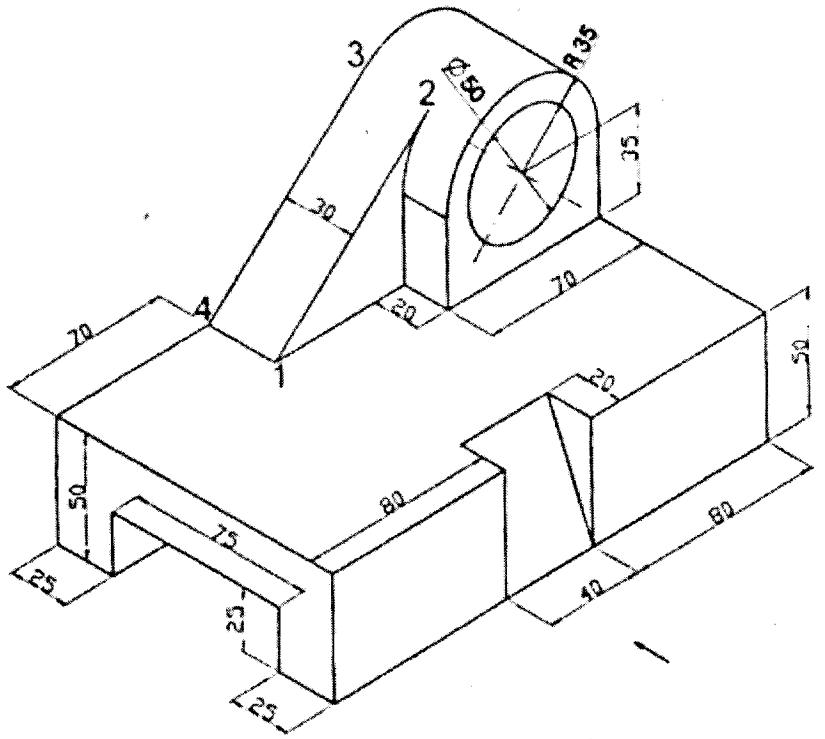
INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 60 MARKS AND HAS A TOTAL OF THREE (3) QUESTIONS
2. ANSWER QUESTIONS 1, & 2 ON THE SAME A3 PAPER
3. QUESTION 3 SHOULD BE ANSWERED ON A SEPARATE A3
4. ATTEMPT ALL QUESTIONS

1. A regular pentagon of 30 mm sides is resting on HP on one of it's sides while it's opposite vertex (corner) is 30 mm above HP. Draw projections when side in HP is 300inclined to VP **[15 marks]**

2. Rectangle 30 mm and 50mm sides is resting on HP on one small side which is 30° inclined to VP, while the surface of the plane makes 45° inclination with HP. Draw it's projections **(15 Marks)**

3. Draw three views of the following component in third angle projection. Show all hidden detail where necessary and fully dimension your drawing. **(30 Marks)**



END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGF 3042: INSTRUMENTAL METHODS IN FOOD ANALYSIS - PRACTICAL

Time Allowed: Three (3) hours. **Total Marks: 100**

Instructions

1. **Please read the instructions and each question carefully.**
2. This examination practical paper has two (2) sections.
3. **Answer each section** in a different Booklet.
4. **There are a total of four (4) Questions.** ANSWER ALL questions.
5. Each question carries 25 marks.
6. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A

This section has one question containing sub-questions. Answer this section in a separate answer booklet

QUESTION 1 [25 MARKS]

Question 1 is all about some of the various laboratory experiments conducted during the practical sessions in AGF 3042 Course namely:

a) HPLC [8 Marks]

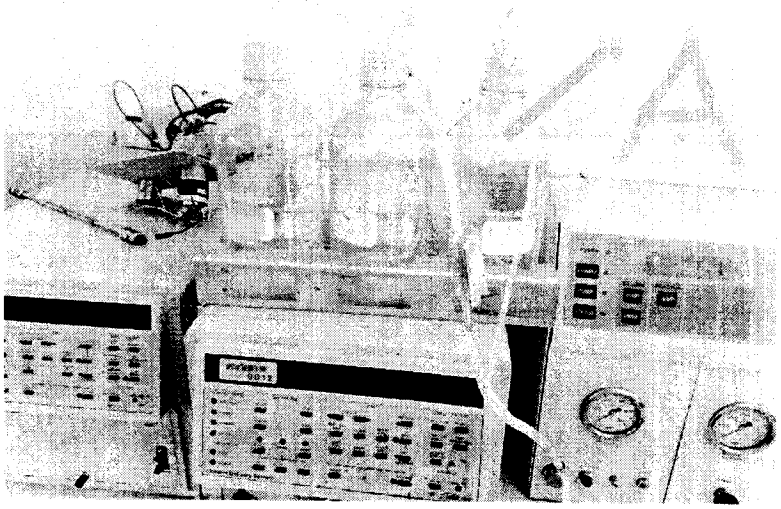


Figure 1: A representation of HPLC instrumentation setup

i. What do the acrimony HPLC stand for? **(1 Marks)**

ii. List the 4 major components of the HPLC. **(2 Marks)**

iii. List any 4 tests or analyses that can be performed using the HPLC. **(2 Marks)**

iv. Identify the role of part labelled A in the displayed image of the HPLC. **(1 Marks)**

v. What type of elution is used in the HPLC as seen in the image? **(2 Marks)**

b) Refractometry [6 Marks]

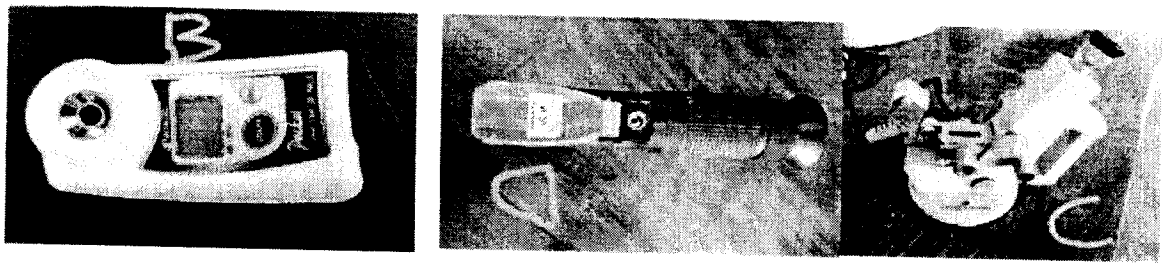


Figure 2: Types of refractometers used in refractometry

i. Identify specimen B, C and D in the image above. **(2 Marks)**
ii. What advantage has specimen B have over specimen C? **(2 Marks)**
iii. Name two (2) analyses that can be read using specimen C. **(2 Marks)**

c) UV-Visible Spectroscopy and Atomic absorption Spectroscopy [6 Marks]

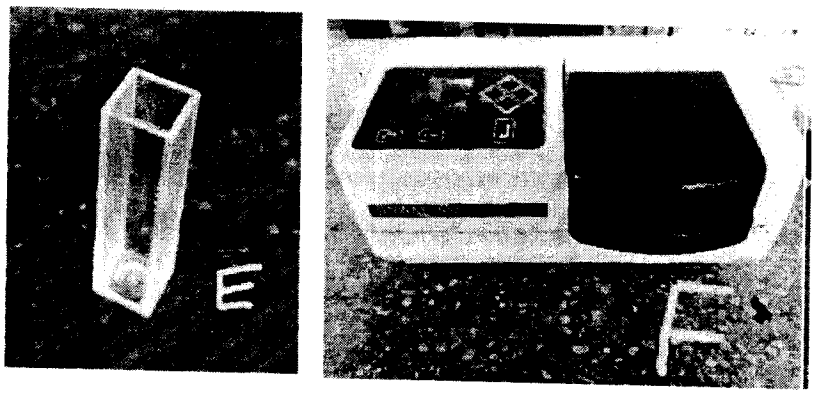
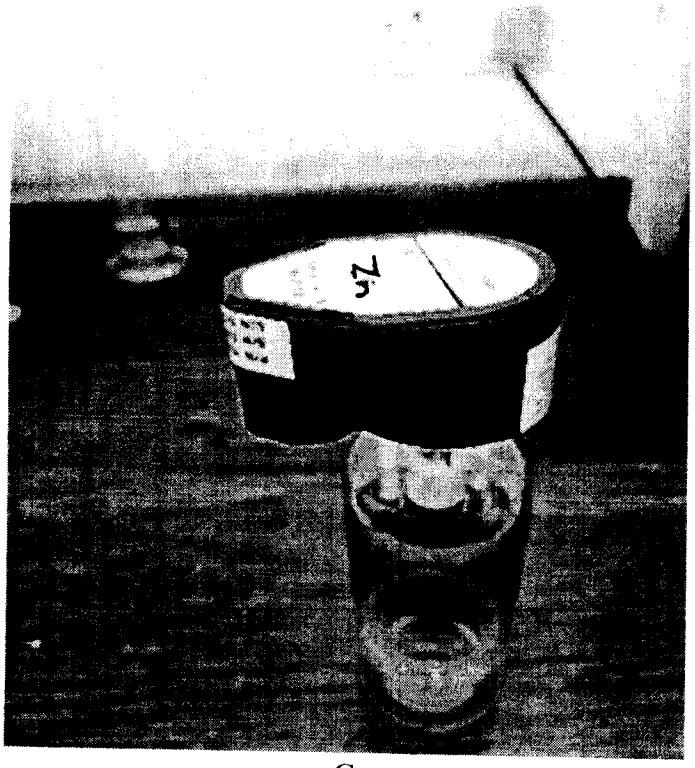


Figure 3: Shows the apparatus and instruments used in UV-Vis Spectroscopy

i. Identify specimen E and F. **(2 Marks)**
ii. What is the principle behind the operation of specimen F in an experiment? **(2 Marks)**

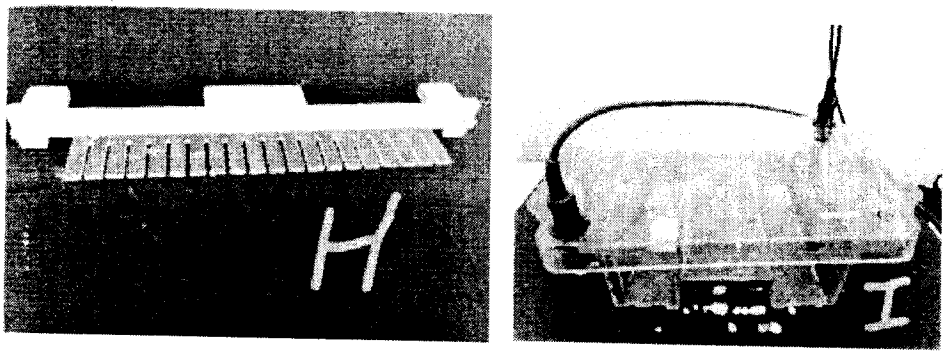


G

Figure 4: Shows a component used in AAS

iii. What is specimen G shown in Figure 4 and what element can be read using this specimen? **(2 Marks)**

d) Gel Electrophoresis [5 Marks]



H I

Figure 5: Components of a Gel Electrophoresis setup

i. Identify specimen H and I. **(2 Marks)**
ii. What is the role of specimen H in Gel electrophoresis? **(1 Mark)**
iii. Mention any 2 tests that can be carried out using Gel electrophoresis. **(2 Marks)**

SECTION B

This section has three (3) questions containing sub-questions

QUESTION 2 [25 MARKS]

A newly established soybean processing company brings to you three (3) cooking oil products (Products A, B and C) requesting for checking the quality of the oils. As a trained laboratory specialist in food chemistry:

a) What parameters can you analyze for in the products? **(2 Marks)**

b) Give reasons to why you have to analyze for the parameters stated in part 2a). **(5 Marks)**

c) After analyzing the products using the Abbe Refractomer, the refractive indices were 1.4688, 1.4705 and 1.4720 for Product A, B and C, respectively. What could be the refractive indices of the products if the temperatures were 18.5°C, 22°C and 21.5°C for Product A, B and C, respectively during the analysis. **(10 Marks)**

In polarimetry, some compounds exhibit the property of being able to rotate the plane of polarized light.

d) What is meant by Plane-polarized light and how is it achieved? Use illustrations, where necessary. **(2.5 Marks)**

e) Briefly discuss the aspect of optical activity in polarimetry. **(2.5 Marks)**

f) A sample with a concentration of 0.3 g/mL was placed in a cell with a length of 5 cm. The resulting rotation at the sodium D line was +1.52°. What is the $[\alpha]_D$? **(3 Marks)**

QUESTION 3 [25 MARKS]

Proteins are separated using SDS-PAGE. Electrophoresis is performed at 150V for 90 minutes. The current intensity is 100 mA during the experiment. The length of the gel is 10 cm, and the migration distance of the front is 9.1 cm. The relative mobility values of two proteins with molecular weights of 25 kDa and 85 kDa are 0.85 and 0.45, respectively.

a) Illustrate the information provided in form of a gel output. **(2 Marks)**

b) What is the molecular weight of a protein that has a relative mobility of 0.7 in this particular gel? **(10 Marks)**

c) The molecular weight of a dimeric protein is 60 kDa. It has two polypeptide chains with identical weights, linked by one disulphide bond. What mobility would this protein show in the same gel? **(7 Marks)**

d) What would be the mobility of this protein in the presence of mercaptoethanol? **(6 Marks)**

Additional information

SDS-PAGE denatures proteins. So a dimeric protein becomes a monomeric protein when treated with SDS. Treatment of a monomeric protein with mercaptoethanol reduces its molecular weight by half.

QUESTION 4 [25 MARKS]

UV-Vis spectrophotometer, when operated under absorption mode obeys Beer Lamberts Law.

a) Discuss the concept of the Beer Lamberts Law in detail using expressions and illustrations, clearly stating what is meant by deviation from the law. **(10 Marks)**

b) Why should the cuvettes used in UV-Vis spectroscopy be matched? In addition, explain how handling of cuvettes is done. **(5 Marks)**

c) A series of five standard copper solutions is prepared, and the absorbances measured as indicated in the table. Determine the concentration of the unknown. **(10 Marks)**

A	C (ppm)
0.104	1
0.198	2
0.310	3
0.402	4
0.500	5
0.334	Unknown

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

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF FOOD SCIENCE AND NUTRITION

END OF YEAR EXAMINATIONS

2022/23 ACADEMIC YEAR

AGF 3100: GENERAL AND FOOD MICROBIOLOGY (THEORY)

Time Allowed: Three hours. **Total Marks: 100**

Instructions to the Candidates

1. The examination paper has two sections. Section A and Section B.
2. Section A has four (4) questions. Answer **any three (3) questions.**
3. Section B has three (3) questions. Answer **any two (2) questions.**
4. You are required to answer a **total of five (5) questions.**
5. The allocated marks for each question are indicated in the brackets.
6. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A

There are **FOUR (4)** questions in this section. Answer **ANY THREE (3)** questions.

Question One

a) What was the Theory of Spontaneous Generation? **[2 Marks]**

b) Why was the theory of Spontaneous Generation historically and scientifically important? **[3 Marks]**

c) What contributions to the field of microbiology were made by the following? And what is the significance of their contribution to modern microbiology?

i. Robert Hook **[3 Marks]**
ii. John Tyndall **[3 Marks]**
iii. Alexander Fleming **[3 Marks]**

d) Identify three (3) characteristics common to prokaryotic and eukaryotic cells and explain how they are similar or different. **[6 Marks]**

Question Two

a) Classify microorganisms based on

i. Preferred temperature ranges **[8 Marks]**
ii. Osmotic pressure **[4 Marks]**

b) List any two (2) toxic forms of oxygen to microorganisms **[2 Marks]**

c) Contrast aerobic respiration, anaerobic respiration and fermentation in microbial metabolism **[6 Marks]**

Question Three

a) Compare and contrast protozoa, virus, viroid, and prion **[6 Marks]**

b) Describe the life cycle of common yeast *Saccharomyces cereviciae* **[8 Marks]**

c) Give example of one biological, one chemical and one physical mutagen and describe the mechanism by which each causes a mutation -> **[6 Marks]**

Question Four

a) Describe how the following components or nature of pathogens help them penetrate or evade host defenses and cause disease:
   i. Mycolic acid (waxy) of Mycobacterium tuberculosis **[2 Marks]**
   ii. Hemolysins (produced by Staphyloccoci and Streptoccoci) **[2 Marks]**
   iii. Antigenic variation **[2 Marks]**

b) Describe any three (3) components of the innate immunity's first line of defense **[6 Marks]**

c) Describe the mechanism and steps of phagocytosis **[8 Marks]**

Section B

There are **THREE (3)** questions in this section. Answer **ANY TWO (2)** questions.

Question Five

a) Describe the effect of the following on microorganisms:
   i. pH **[4 Marks]**
   ii. Ionizing radiation **[4 Marks]**
   iii. Osmotic pressure **[4 Marks]**

b) Differentiate between pascalisation and sterilisation. Give one (1) advantage and one (1) disadvantage for each of the above methods of food preservation **[8 Marks]**

Question Six

a) Explain in detail why fresh meat easily spoils. List two (2) spoilage microorganisms and two (2) pathogenic microorganisms associated with fresh meat **[8 Marks]**

b) Explain in detail why milk spoils easily despite possessing a number of antimicrobial substances **[4 Marks]**

c) Differentiate, with examples, between food infection and food intoxication **[3 Marks]**

d) Listeriosis is a typical foodborne disease of public health concern because of its severity and non enteric nature of disease
   i. Identify two (2) important characteristics of *Listeria monocytogenes* that promote its ability to be transmitted via food **[3 Marks]**
   ii. List two (2) foods associated with *Listeria monocytogenes* **[2 Marks]**

Question Seven

a) Write brief notes on the following chemicals used as cleaning compounds (detergents)
   i. Basic alkalis **[3 Marks]**
   ii. Acids **[3 Marks]**
   iii. Surfactants **[3 Marks]**
   iv. Sequestering agents **[3 Marks]**

b) Define biofilm and state the purpose of biofilm formation for microorganisms **[4 Marks]**

c) Explain why biofilms are difficult to clean and disinfect **[4 Marks]**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGF 3412: FOOD TOXICOLOGY

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has two sections.
2. Section A is compulsory and
3. Section B has ~~four~~ five questions. Answer **any four** questions in section B.
4. You are required to answer a total of five (5) questions.
5. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A

MULTIPLE CHOICE QUESTIONS **[20 marks]**

There are 20 questions in this section. Answer all questions, each question carries 1 mark

1. Which of the following substances can be excreted in the urine via active tubular secretion in the proximal renal tubule?

   a) Weak acids and bases

   b) Strong organic acids and bases

   c) Metal substances like mercury and cadmium

   d) Lipid-soluble materials

2. Which of the following statements regarding biliary excretion is true?

   a) The liver has a fast blood circulation, allowing toxins to be excreted quickly in bile.

   b) Bile drains directly into the bloodstream, preventing toxins from being reabsorbed.

   c) Bile is the primary site of excretion for all substances in the body.

   d) Biliary excretion involves both passive diffusion and active transport processes.

3. What is the primary purpose of the acute toxicity test?

   a) To determine the substance's color and odor

   b) To evaluate the taste and texture of the chemical

   c) To identify the chemical's metabolic pathways

   d) To determine the level of the substance that induces mortality in laboratory animals

4. The toxicity of a chemical is dependent on the dose administered and the concentration of the toxic chemical in the target organ

A. True B. False

5. Bilirubin is

A. an oxygen-carrying iron-protein complex

B. a hemoglobin metabolites

C. consists of several cell layers between the maternal and foetal circulatory vessels in the placenta

D. structural barrier to distribution

6. What functional unit of the kidney is responsible for excretion

A. glomerulus

B. proximal tubule

C. nephron

D. distal tubule

7. The presence of large protein molecules and blood cells in the urine is an indication of

A. diseased glomerulae

B. large capillary pores

C. their lipid solubility

D. that the kidney is functioning well

8. Food processing/preparation operations can include the following, except

A. Addition of thermal energy and elevated temperatures

B. Removel of thermal energy and reduced temperatures

C. Polymerization and condensation reactions

D. Removal of water and reduced moisture content

9. The common food processing and preparation toxicants include the following except

   A. Maillard reaction products

   B. Lysinoalanine

   C. Muscarine

   D. Lipid oxidation products

10. The compounds formed from the incomplete combustion of organic materials are

   A. Lysinoalanine

   B. Heterocyclic aromatic amines

   C. Maillard reaction products

   D. Polycyclic aromatic hydrocarbons

Short answer questions [1 mark each]

11. List the effects of arsenic exposure.

12. The increase in concentration of a substance, e.g a pesticide, in the tissues of organisms at successively higher levels in a food chain is termed_____.

13. The paralytic disease resulting from consumption of shellfish (clams, mussels, oysters, etc) that have ingested toxic marine algae is caused by the toxin_____.

14. What are the major routes of exposure to toxicants for an organism?

15. Define the structural barriers to distribution of toxicants.

16. What are mycotoxins?

17. What is *in vitro* toxicity testing?

18. List the big eight (8) allergenic foods.

19. What is the mechanism of action of the cholinesterase inhibitor, solanine.

20. What does the Acceptable daily intake (ADI) measure?

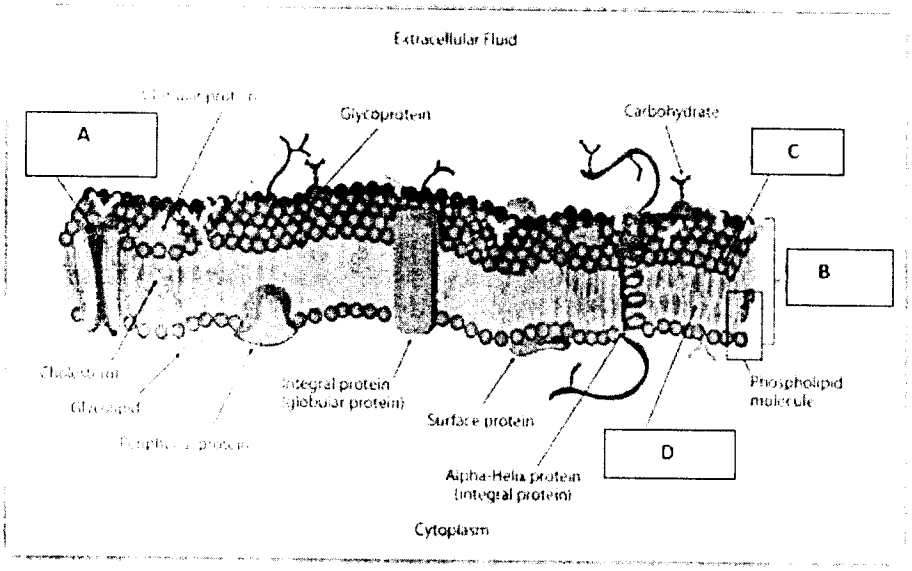
Section B Answer Four questions from this section

Question One

1. What is the difference between a local effect and a systemic effect **[3 marks]**
2. List the three minor routes of toxicant exposure. **[3 marks]**
3. What is muscarinic poisoning? **[2 marks]**
4. How does muscarinic poisoning manifests as? **[2 marks]**
5. List the four reasons why nitrite is added to foods in the curing of meat and fish. **[4 marks]**
6. Provide a concise (one sentence definition) of the following terms
   - i) No Observed Adverse Effect Level (NOAEL) **[2 marks]**
   - ii) Median lethal dose ((LD_{50}) **[2 marks]**
   - iii) Therapeutic index **[2 marks]**

Question Two

1.



a. Name the parts labelled A, B, C and D? **[2 marks]**

b. What is the function of the part labelled A. [2 marks]

c. Describe the specialized transport systems that occur in a plasma membrane during the passage of toxicants from one side of the membrane to the other. [5 marks]

d. The target organs for cadmium toxicity are the kidney and the respiratory system (lungs and bronchi). Describe the symptoms of the cadmium toxicity to these organs. [4 marks]

e. What is a pesticide? [2 marks]

d. List the problems associated with pesticide use in a home. [5 marks]

Question Three

a. List the main organ systems involved in excretion of xenobiotics [3 marks]

b. What is a food allergy? [1 mark]

c. What is a food intolerance? [1 mark]

d. Discuss the metabolic food intolerance. [6 marks]

e. Some plants contain compounds that inhibit cholinesterase activity.

i. Name one such plant and the compound that is found in the plant. [2 marks]

ii. What is the mechanism of action of the compound you have named in (i) above [4 marks]

iii. Contrast food borne infections and food borne intoxication. [3 marks]

Question Four

a. Explain how the enterohepatic circulation prolongs the life of the xenobiotic in the body [5 marks]

b. In *in vivo* tests, the principal tool for determination of toxicity of chemicals is using animal models. Discuss how acute and chronic testing is performed using animals, stating the important components such as period of exposure and final result of the test. [10 marks]

c. What is fugu poison? [5 marks]

Question Five

a. What is biotransformation? [2 marks]

b. What is the major function of biotransformation [2 marks]

c. A food allergy is an immune system response to a food or substance in the food, usually a protein or glycoprotein, that the body mistakenly believes is harmful. How is food allergenicity determined in susceptible individuals? Describe two methods used to determine food allergenicity comprehensively. [6 marks]

d) The Food Safety Act of 2019 is an Act by the government of the Republic of Zambia to provide for, among many other things, the protection of the public against health hazards and fraud in the manufacture, sale and use of food; provide for a streamlined process for regulatory clearances for regulatory health requirements for food premises; establish the Food Safety Coordinating Committee and provide for its functions and powers.

i) State at least five (5) provisions in this law. [5 marks]

e. Differentiate between acute and chronic toxicity testing. [5 marks]

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

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

2023 ACADEMIC YEAR – FINAL EXAMINATIONS

COURSE: AGF 4052
Sensory Evaluation of Foods

Date: Monday, 20th November 2023 **Time: 14.00 – 17.00 Hours**

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

INSTRUCTIONS TO CANDIDATES:

1. There are two (2) sections in this examination paper, Section A and Section B.
2. **Section A and Section B carry equal marks (50 marks).** The marks allocated are given at the end of each question.
3. Answers to the two sections should be given in separate booklets. Clearly label each booklet as Section A and Section B.
4. Find also attached **table T4** – Upper α-probability points of student's t-distribution, **table T5** – Upper α-probability points of χ^2-distribution and **table T6**-Upper α-probability points of F-distribution

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A: Answer all Questions

QUESTION 1

(a) Define the following terms: (i) Organoleptic; (ii) Anosmia; (iii) Ordinal data; (iv) Ageusia; and (v) Pitch (in sound) **[1 mark each = 5 marks]**

(b) State two (2) differences between the following pairs;

(i) Parametric and non-parametric tests **[1 mark]**

(ii) Gustation and trigeminal perceptions **[1 mark]**

(iii) Difference-From-Control and the Simple Difference Tests **[1 mark]**

(iv) Recognition and difference thresholds **[1 mark]**

(v) Kinesthetic and somesthestic perceptions **[1 mark]**

(c) Briefly, describe how you would perform and analyze the data for each of the following overall difference tests:

(i) Triangle test **[2 marks]**

(ii) Duo trio test – Balanced mode **[2 marks]**

(iii) Harris-Kalmus test **[2 marks]**

(d) Presentation of the matched pair in a simple difference test enables the sensory analyst to evaluate the magnitude of the "placebo effect" of simply asking a difference question."

(i) What is meant by "placebo effect?" **[2 marks]**

(ii) Justify this statement. **[2 marks]**

QUESTION 2

(a) New investors in Zamanita (Zambia) intend to modernize the cooking oil plant by replacing an old solvent extraction equipment with a new model. The cooking oil from the old solvent extraction plant is labeled **"Cooking oil A"** while that in the new extraction plant is labeled **"Cooking oil B".** The original, **cooking oil A**, has a slight beany flavour which has a carryover effect. In previous market surveys it was, however, proven that the consumers like this slight beany flavour. The Plant Manager hires you as a Sensory Evaluation Consultant. To provide the Plant Manager with the information to his queries given below, you conducted a sensory test. In this sensory test, you obtained a total of 60 responses, 30 matched pairs and 30 unmatched pairs, collected from 60 panelists. Each panelist evaluated either a matched pair (cooking oil A/cooking A or cooking oil B/cooking oil B) or unmatched pair (cooking oil A/cooking oil B or cooking oil B/cooking oil A) in a single session. The sensory test was conducted in the

booth area under red lights. For the matched pairs, 17 panelists said the samples were the same and 13 panelists said the samples were different. On the other hand, in the unmatched pairs, 9 panelists said the samples were the same and 21 panelists said the samples were different.

(i) State with reason(s) what kind of sensory test you carried out to obtain this kind of data **[2 marks]**

(ii) Why was the test performed under red light? **[1 mark]**

(iii) Give advice, outlining your basis, to the Plant Manager regarding his two queries below **[10 marks]**

I. The Plant Manager would like to know if the cooking oil produced in the new extraction equipment **(Cooking oil B)** is the same as that made in the old solvent extraction plant **(Cooking oil A)**.

II. Secondly, the Plant Manager would like you to determine if the new solvent extraction equipment can be used in place of the old solvent extraction equipment.

(iv) In your opinion, what decision is the Plant Manager likely to make? **[2 marks]**

QUESTION 3

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

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

(b) Which prototype would be considered different by consumers, if any?

(c) Would you use the panelists used in this test again? Give reason(s) why you would or would not use them again **[15 marks]**

USEFUL INFORMATION FOR SECTION A

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

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

SECTION B: ANSWER ALL QUESTIONS

1. What are Affective Tests? Name and briefly describe where these tests are used **[5 marks]**

2. Mention and describe five specific areas of the Industry where Affective tests are utilized **[15 marks]**

3. Before developing of a Panel, give three chronological order of events of what needs to be done in order to achieve success in selection and training of would be Panel Members **[5 marks]**

4. STUDY THIS Table:

CHARATERISTIC	SAMLE A	SAMPLE B
Fried Potato	7.5	4.3
Raw Potato	1.1	3.7
Vegetable Oil	3.6	1.1
Salty	6.2	13.5
Sweet	2.2	1.0

   (a) What is it depicting in as far as product development is concerned?

   (b) What are the differences and similarities between the two samples? What else can you learn by looking at the ingredients and characteristics of the samples? In terms of statistics and sensory analysis **[15 marks]**

5. How does knowledge of common terminologies help people in food tests **[5 marks]**

6. What is involved in modified short version of the Spectrum procedure for quality assurance and shelf life studies **[5 marks]**

END

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGF 4210: UNIT OPERATIONS IN FOOD ENGINEERING - THEORY

Time Allowed: Three (3) hours. **Total Marks: 100**

Instructions

1. The examination paper has Section A & B and contains six (6) questions
2. **Answer each section** in a different Booklet.
3. **Answer any two (2) questions from Section A and any two (2) from Section B**
4. Each question carries 25 marks.
5. Write in a legible handwriting.
6. Useful information is provided at the end of the question paper.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A

This section has three (3) questions, answer any two (2)

Question 1 [25 Marks]

(a) A cereal beverage with density of 1000 kg m^{-3} flows at the rate of 1440 m^3 h^{-1} in a 7.5 cm diameter pipe at a pressure of 70 kPa. If the pipe reduces to 5 cm diameter, calculate the new pressure in the pipe. **(12.5 Markss)**

(b) Define viscosity and give one reason why it is important in fluid flow **(6 Marks)**

(c) Using a shear stress/shear rate relationship, show graphically how Newtonian, Pseudoplastic, Dilatant and Bingham fluids behave. **(6.5 Marks)**

Question 2 [25 Marks]

Consider 100 kg of pineapple fruit from which the juice is extracted by pressing. The fruit enters the pressing machine with the juice content of 70% wt and soluble sugar comprise of 15% of the juice. At the end of the extraction process, the pressed solid (pomace) contains 10 % juice. The clear juice extracted contains 15.5% sugars. All percentages are on weight basis.

(a) Perform the overall material balance **(9 Marks)**

(b) Perform component balance on sugars **(9 Marks)**

(c) What does the Law of Conservation of Mass states? Is it holding in this case? **(8 Marks)**

Question 3 [25 Marks]

(a) Outline advantages and disadvantages of using a batch and Continuous Stirred Tank Reactors (CSTR) in yeast cultivation. **(6 Marks)**

(b) Centrifugal separations are commonly used in the food industry, describe the principal and give examples of food products that can be separated by this method. **(6 Marks)**

(c) What is Grass Transition Temperature? Why is it important in the storage of powdered food products? Is this tool useful to multi component powders? **(6 Marks)**

(d) Describe problems that occur during handling, storage and transportation of powdered food products and why? How can each of these problems be avoided or solved? **(7 Marks)**

SECTION B

This section has three (3) questions, answer any two (2)

Question 4 [25 Marks]

(a) In cereal processing, maize or corn undergo wet milling to produce corn starch other related products. Discuss in detail the staged and/or steps in wet milling and list the end products obtained from this process. **(15 Marks)**

(b) Crystallization as a unit operation as found broad applications in the food sector and other fields such as the pharmaceutical industry, among others. Briefly discuss the steps involved in crystallization process. Use illustrations where necessary. **(10 Marks)**

Question 5 [25 Marks]

A continuous single-effect evaporator concentrates **9072 kg/h** of a **1.0 wt %** salt solution entering at **311.°K (37.8 °C)** to a final concentration of **1.5 wt %.** The vapor space of the evaporator is at **101.325 kPa** (1.0 atm abs) and the steam supplied is saturated at **143.3 kPa**. The overall coefficient **U = 1704 W/m^{2}K**. Assumed that, since it its dilute, the solution has the same boiling point as water.

(a) Calculate the amounts of **Vapor and Liquid products (10 Marks)**

(b) Calculate **Heat-transfer Area (6 Marks)**

(c) List three advantages of multiple effect evaporators over single effect evaporator? **(9 Marks)**

Question 6 [25 Marks]

An evaporator is used to concentrate **4536 kg/h** of a **20%** solution of **NaOH** in water entering at **60°C** to a product of **50% solids**. The pressure of the saturated steam used is **172.4 kPa** and the pressure in the vapor space of the evaporator is **11.7 kPa**. The overall heat-transfer coefficient is **1560 W/m^2.K.**

(a) Calculate the amount of Steam used and determine the Steam Economy. **(10 Marks)**

(b) Calculate the heating surface **Area** in m^2 for this unit. **(6 Marks)**

(c) List three components of an evaporator and briefly describe each one's function? **(9 Marks)**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGF 4300: FOOD PROCESSING AND PACKAGING

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has two sections.
2. Section A has five questions; Answer three questions
3. Section B has three questions; Answer two.
4. You are required to answer a total of five (5) questions.
5. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A Answer THREE questions in this section

Question One

a. Evaporation is a method used to concentrate products and reduce its bulk. This reduces on storage and transportation cost.

i. Describe the equipment required to operate an evaporation plant that will be used to evaporate milk to 50% total solids. Include in the description measures and equipment to reduce the energy costs of running the facility. **[12 marks]**

ii. List three other applications of evaporation in addition to preconcentration and reduction of bulk storage. **[2 marks]**

b. Define the following terms

i. D value **[2 marks]**

ii. Z value **[2 marks]**

iii. F_0 **[2 marks]**

Question Two

a) Heat treatment plays an important role in food processing. The major aims of heat treatment are inactivating microorganisms and enzymes, and to change the physical and sensory properties.

i. How is a heat treatment optimized to maintain nutrients but at the same time to inactivate the microorganisms and enzymes? **[4 marks]**

ii. What is the difference between sterilization and ultra high temperature heat treatment? **[2 marks]**

iii. What are the effects of ultra high temperature treatment on foods? **[2 marks]**

b. Freezing is a method of preservation which can minimize changes in food quality.

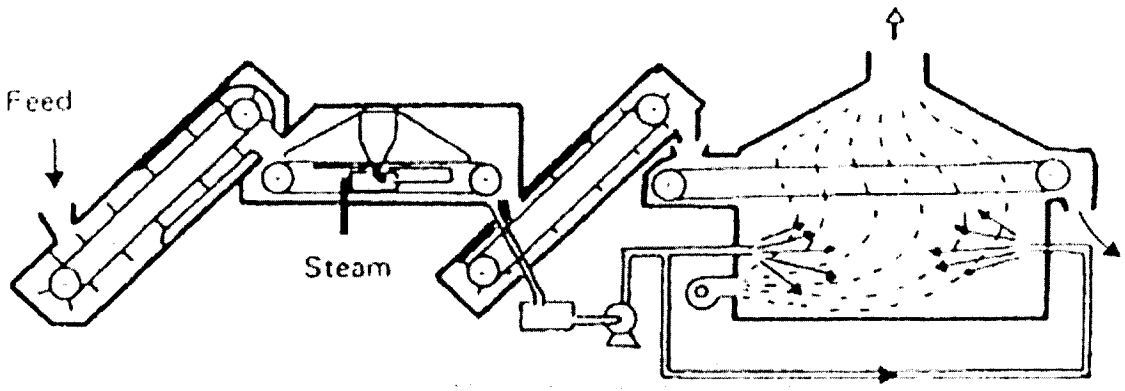
i) List the two main reasons for blanching vegetables before freezing. **[2 marks]**

ii) Draw a typical freezing curve. Label the curve with the phenomenon occurring during each temperature or temperature range. **[6 marks]**

iii) What four changes can occur in foods during frozen storage which can determine the shelf life of the frozen food. **[4 marks]**

Question Three

a) The equipment below is used for individual quick blanching. Describe how this equipment operates, starting from the intake of the product to the out where the product is cooled after the processing. **[6 marks]**



(a)

b) Define the following in short and concise notes (five lines or less)

i. Cobalt-60 **[1.5 marks]**

ii. Radicidation **[1.5 marks]**

iii. Vacuum cooling **[1.5 marks]**

iv. Contact freezing **[1.5 marks]**

v. Lethal value **[1.5 marks]**

vi. Commercial sterility **[1.5 marks]**

c) List three advantages of aseptic processing over conventional canning. **[3 marks]**

d) State the two potential problems of irradiation that may arise with respect to microbial destruction **[2 marks]**

Question Four

a) List five (5) conditions necessary for microorganisms to grow and then relate your answers to the methods of preservation which you have studied in this course, which can be used to control the microorganisms. **[10 marks]**

b) The maintenance of composition of gases in a chilling room for cooling vegetables and fruits that are respiring is an important aspect of this preservation technology. Discuss two methods of how carbon dioxide is removed from the atmosphere in a cooling chamber using scrubbers. **[5 mark]**

c) List the advantages of freezing over chilling. **[5 marks]**

Question Five

a) Thermal Properties of foods are specific heat and thermal conductivity. Define the two terms "specific heat" and "thermal conductivity" **[4 marks]**

b) Heat treatment of food such as sterilization lead to changes in the texture or viscosity, color and flavour and aroma (sensory) characteristics of the food. Select a food (milk, vegetables, or meat) and describe the changes that occur in the sterilized food that you have selected. **[4 marks]**

c) List the equipment that is used for pasteurization of packaged food and the equipment used for pasteurization of unpackaged food, clearly indicating which equipment is for which type of foods. **[4 marks]**

d) Compare and contrast deep fat frying and shallow (contact) frying. **[4 marks]**

e) State the three characteristics of air that are necessary for successful drying when the food is moist. **[4 marks]**

Section B Answer two questions in this section

Question Six

Countries worldwide regulate their foods for two reasons.

(a) Name these reasons **[2 marks]**

(b) Countries with no standards can still trade with each other provided they adhere to acceptable norms. What are these? **[5 marks]**

(c) Describe in detail Aseptic Packaging. Name two companies using this technology in Zambia. Give examples of products made using this technology **[13 marks]**

Question Seven

When choosing a packaging system for food products, the science must be technically correct and also well understood. Expand on this. **[20 marks]**

Question Eight.

In food kinetics of packaged foods, some food attributes are lost due to some environmental and chemical factors.

(a) Describe three of those factors **[5 marks]**

(b) Under compatibility of food and food package, name five situations associated with this phenomena **[5 marks]**

(c) Name four types of packaging waste and one which is not **[5 marks]**

(d) In your own words, describe the status of packaging in Zambia **[5 marks]**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGF 4422: WATER AND FOOD WASTE TREATMENT - THEORY

Time Allowed: Three (3) hours. **Total Marks: 100**

Instructions

1. Please read the instructions and each question carefully
2. **The examination paper has a total of five (5) Questions.** ANSWER ALL questions.
3. Each question carries 20 marks.
4. Write in a legible handwriting.
5. Useful information is provided at the end of the question paper.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

QUESTION 1 [20 MARKS]

(a) Name four sources of drinking water; name the place where Lusaka water is treated and name where water from the treatment plant is stored (10 marks)

(b) describe the following

(i) Trickling filter (5 marks)

(ii) Activated sludge (5 marks)

QUESTION 2 [20 MARKS]

What are Genetically Modified Organisms (GMOs)? Mention and describe five areas where they are used. (20 marks)

QUESTION 3 [20 MARKS]

(a) Air pollution management is relatively new in Environmental Pollution Management. What prompted its inclusion in Pollution Management? (5 marks)

(b) Describe in detail the two methods covered in class used to manage air pollution (15 marks)

QUESTION 4 [20 MARKS])

Define the following (2 marks)

(a) Ponding

(b) BOD

(c) COD

(d) Patent

(e) PACRA

QUESTION 5 [20 MARKS]

Compositing is one of the best methods of waste disposal as it can turn unsafe organic products into useful soil conditioner.

(a) Give two types of windrow designs that are commonly used in compositing **(5 marks)**

(b) Describe passively and actively aerated windrows **(10 marks)**

(c) Discus five factors that affect the compositing process **(5 marks)**

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

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGG 2742: AGROMETEOROLOGY CLIMATE CHANGE AND FOOD SECURITY

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has five (5) compulsory questions
2. Answer **ALL** questions
3. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Question One [20 marks]

Briefly explain the following terms and concepts.

a) Atmosphere
b) Weather
c) Albedo
d) Radiation
e) Climate
f) Climate change
g) Return period
h) Growing degree days
i) Food security
j) Greenhouse effect

Question Two [10 marks]

There has been significant level of consensus amongst scientists that there has been a global temperature change on Earth. What are these agreed changes according to IPCC (2001)?

Question Three [25 marks]

Given the following meteorological data as measured on 10th January 2023 in Mbala (Northern Zambia) located at Latitude: 8°50'24"S Longitude: 31°21'57" E and 1622 m above sea level:

Maximum temperature	35°C
Minimum temperature	25°C
Maximum relative humidity	80 %
Minimum relative humidity	68 %
Actual sunshine hours	5.9 hours
Sunset hour angle (w_s)	1.527 radians
Extraterrestrial radiation (Ra)	50 MJ m^{-2} day^{-1}

Determine

a) Saturation vapour pressure (e_s)

b) Actual vapour pressure (e_a)

c) Declination angle (dr)

d) Sunrise and Sunset time for this day

e) Solar radiation (Rs)

f) Clear-sky solar radiation (R_{so})

Question Four [10 marks]

There is significant level of error in manually-operated weather stations. What measures can be taken to reduce these?

Question Five [15 marks]

The atmosphere is made up of several layers, and one of these is the Troposphere.

a) What is the importance of the Troposphere to human life?

b) Describe the main characteristics of the Troposphere.

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

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

END OF YEAR EXAMINATION

2022/23 ACADEMIC YEAR

AGG 3822: AGRICULTURAL EXTENSION

Time Allowed: Three Hours **Total Marks: 100**

Instructions

1. The examination paper has two sections.
2. Section A is short type questions. Section B is essay type question
3. Answer all questions in Section A and B.
4. You are required to answer a total of eight (8) questions.
5. Write in a legible handwriting

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A: Short Type Questions

1. Briefly discuss any three common principles of the participatory approach (9 marks)

2. "Gender awareness issues are an important inclusion in rural extension agency activities" Using known examples, explain the term gender and clearly state the two extension problems such an awareness tries to solve (8 marks)

3. Define an extension programme plan and briefly state any three advantages of having an extension programme plan (9 marks)

4. Under which approach would "bottom to bottom" diffusion of innovation process occur? Explain and list at least three advantages such an approach has over other known approaches (8 marks)

5. The Department of Agriculture is considered the primary provider of agriculture extension service. Mention the three branches and their specialized functions (6 marks)

Section B: Essay Type Questions

1. Distinguish between group and mass extension methods. For each method give examples and state its advantages and disadvantages

2. The "innovation decision process is usually considered as a series of steps or functions. Fully discuss these steps and indicate what the desirable change at each of the steps is.

3. Having studied extension organization theory, describe any five aspects of this theory that would help you improve the design and operational efficiency of extension service systems.

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2022/2023 END OF YEAR EXAMINATIONS

COURSE : AGG 3832 FORAGE CROP PRODUCTION AND RANGE MANAGEMENT
DATE : 13TH NOVEMBER 2023 14:00 HOURS
DURATION : THREE HOURS
INSTRUCTIONS : ANSWER ANY FIVE QUESTIONS

Question 1

In range management it is important to carry out a natural resource inventory

a) In natural resource inventory mention the six types of plant attributes that are commonly measured. (6 marks).

b) The following data of two desirable browse species Moringa and Leucaena was collected from 12 quadrants from grazing area in Central Province. Each quadrant was 10 meters x 10 meters

Quadrant No.	1	2	3	4	5	6	7	8	9	10	11	12
Number of moringa plants	2	0	5	3	11	0	1	12	0	3	9	4
Number of Leucaena plants	3	1	1	0	0	0	2	0	0	1	0	1

i) Calculate
The frequency of moringa and of Leucaena [8 marks]

ii) Which of the two has better results in terms of frequency [6 marks].

Total 20 marks]

Question 2

Differentiate between zero grazing and rotational grazing [20 marks]

Total [20marks]

Question 3
Pasture grasses and legumes are an importance component of the ecosystem in grazing lands.

a) Give examples of three pasture grasses and two pasture legumes. Please indicate their scientific names as well. [5mark].
b) Outline five differences between pasture grasses and legumes. [10mark]
c) Discuss the benefits of having grass/legumes mixture in grazing lands compared to pure grass or pure legume stands? [5mark]

Total [20marks]

Question 4
Rangelands have been neglected for a long time in programmes concerning agricultural development although they are very importance as sources of livelihoods for the local people?

a) Describe are the characteristics of range lands? [4 marks]
b) Mention products of economic importance that can be derived from rangelands. [6 marks].
c) Outline the causes of land degradation in these rangelands? [4 marks].
d) Discribe the management practices that should be carried out to conserve and improve the productivity of the rangelands? [6 marks].

Total [20marks]

Question 5
A farmer in Chisamba has the following herd of cattle 6 Angoni 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) How much grazing land does the farmer need?. [15 marks].
b) Explain what the farmer would need to do if he had only 250 hectares of land to keep the same number of animals [5 marks].

Total [20marks]

Question 6

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) Outline the procedure of hay making. [12 marks].

b) Explain how you would tell the difference between good and bad hay [8 marks].

Question 7

Energy flows through the ecosystem via food webs, they are arranged by feeding levels.

a) Define an ecosystem. [5 marks]

b) Describe the components of an ecosystem in rangelands? [8 marks].

c) What are ecosystem goods and services. Explain and give examples. [7marks]

Total [20marks]

Question 8

During one of the forage crop production lessons a student was asked to define rotational grazing and he said that rotational grazing is a kind of grazing where the animal rotates while it is grazing. The other students upon hearing this laughed a lot.

a) From your understanding of rotational grazing would you agree or disagree with this definition? Give an explanation for your answer (5 marks).

b) What are the benefits of rotational grazing (4 marks).

c) What are the factors that affect grazing time (6 marks).

d) Determine the number of 280kg heifers a 80-hectare pasture will support for 100 days, given a pasture yield of 2,000kg of dry matter per hectare. Take Dry matter intake of the animals to be 3% of their body weight. (5 marks).

Total [20marks]

THE END

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	1.3	1.6	1.3	0.7	0.3	0.2

Devon						
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

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – NOVEMBER, 2023

AGG 3842
INTRODUCTORY STATISTICS FOR AGRICULTURE

TIME: 3 Hrs. **Marks**: 100

INSTRUCTIONS: Section A has three questions. Answer all three (3).
Section B has two questions Answer only one (1).
You are required a total of Four (4) questions. Write legibly.
Any statistical test should be at 5% significance level ($\alpha = 0.05$).

SECTION A

Question One (1) [25 Marks]

UNZA School of Agricultural Sciences developed a breed of Oranges and named it after the name of the institution, hence the name "UNZA-Oranges". UNZA-Oranges were planted at UNZA School of Agricultural Sciences Research Field Station. Below is a stem and leaf display of the heights in metres of randomly selected UNZA-Orange plants.

0	8
1	
1	8
1	9
2	0 0
2	1 2 3 4
2	
2	5
3	
3	0
4	1 1
4	5

Key

1 | 8 = 1.8 metres

a) What is the range of the UNZA-Orange plant heights? **[1]**
b) Calculate the mean height of the UNZA-Orange plants? **[2]**
c) Determine the median height of the UNZA-Orange plants? **[1]**
d) Identify the mode height of the UNZA-Orange plants? **[1]**
e) What is the interquartile range of the UNZA-Orange plant heights? **[2]**
f) Calculate the variance of the UNZA-Orange plant heights? **[5]**
g) What is the standard deviation of the UNZA-Orange plant heights? **[2]**
h) Variance and standard deviation are measures of variability, what does that imply? **[2]**
i) What is the basic interpretation of a dataset distribution having equal Mean, Mode, and Median? **[1]**
j) It is reported that according to UNZA-Oranges, only plants with the height of 3 metres or more are able to fruit. It is also reported that if anybody walked into an Orchard at any time, 40% of the plants would have the fruits.
   i. What is the probability that exactly 2 in every 4 randomly selected UNZA-Orange plants will have fruits? **[4]**
   ii. What is the probability that 0 in every 2 randomly selected UNZA-Orange plants will have fruits? **[4]**

Question Two (2) [25 Marks]

The average yield of a maize variety in one ha field in Kaoma is 200 tonnes. You believe this may not be the case currently. You pick a random sample of 5 fields and record the following yields:

219	200	225	189	170

a) Is there enough evidence to suggest the average yield in Kaoma has changed? **(10 Marks)**

b) The dean would like to know which days of the week students are most likely to be absent. He expects absentism to be **equal** during the 5-day school week. He selects 100 lecturers and asks them which day of the week they had the highest numbers of absentism, results are below. Do the days of highest number of absences occur with equal frequencies? **(15 Marks)**

	Monday	Tuesday	Wednesday	Thursday	Friday
Observed	18	28	16	14	23

Question Three (3) [25 Marks]

A scientist wanted to determine the effect of adding different levels (1.0%; 1.5%; 2.0%; 2.5% and 3.0%) of Lactose sugar in Coffee drink. He got 20 students in the School of Agricultural Sciences of the University of Zambia offering AGG 3842 to take part in the experiment. He measured and recorded the systolic blood pressure levels and these are presented below.

	Observations			
Treatment Levels of Lactose sugar	1	2	3	4
1.0%	70	72	74	64
1.5%	76	74	76	70
2.0%	78	74	85	66
2.5%	77	84	82	80
3.0%	98	94	90	90

a. Help the scientist to write out the model for the experiment and explain each term. **5 Marks**
b. Write out the hypotheses to be tested. **5 Marks**
c. Using ANOVA, help the Scientist to draw conclusion from the experiment. **10 Marks**

Assuming the data observed above were range of values of a random survey of systolic blood pressure levels,

d. What is the Point estimate for all the observations made? **2 Marks**
e. What is the 95% confidence interval for the actual mean for all students? **3 Marks**

SECTION B

Question Four (4) [25 Marks]

a) You get a six-sided die with no numbers on any sides, you mark it with a 4 on one of its six sides, you mark it with a 3 on two of its five remaining sides, you mark it with a 2 on two of its three remaining sides, and finally you mark it with a 1 on the last side. Your marked die is then flipped twice and the two numbers obtained are added to get a sum. Write a probability distribution table indicating five columns of the following; possible sums, number of outcomes (Combinations) per each possible sum, total number of outcomes (Combinations), probability fraction, and probability percentage. **[14]**
b) Suppose two Zambian one-kwacha fair coins are flipped at the same time but only once, the two sides of each coin being; Birds (B) and Coat of arms (C).
   i. By way of indicating all possible combinations of obtaining coat of arms, write a probability distribution of obtaining coat of arms **[11]**

Question Five (5) [25 Marks]

A father with a rather large family of 10 wanted to draw inferences from the exam scores of the children in two subjects namely, Home Economics (HE) and Drama. The scores are presented below for each student in the respective subject.

Student	HE %	Drama %
1	27	63
2	22	46
3	15	25
4	35	52
5	30	60
6	52	70
7	35	62
8	55	74
9	40	60
10	40	55

a. Is there any relationship between scores in HE and Drama? **5 Marks**
b. Determine a regression equation assuming Drama is the dependent variable. **15 Marks**
c. Predict the likely score in Drama for a student who scored 45% in HE. **5 marks**

END OF EXAMINANTION

T-table statistical table

one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05
df							
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131

Critical Values of the F-Distribution: $\alpha = 0.05$

Denom.	Numerator Degrees of Freedom									
d.f.	1	2	3	4	5	6	7	8	9	10
1	161.448	199.500	215.707	224.583	230.162	233.986	236.768	238.883	240.543	241.882
2	18.513	19.000	19.164	19.247	19.296	19.330	19.353	19.371	19.385	19.396
3	10.128	9.552	9.277	9.117	9.013	8.941	8.887	8.845	8.812	8.786
4	7.709	6.944	6.591	6.388	6.256	6.163	6.094	6.041	5.999	5.964
5	6.608	5.786	5.409	5.192	5.050	4.950	4.876	4.818	4.772	4.735
6	5.987	5.143	4.757	4.534	4.387	4.284	4.207	4.147	4.099	4.060
7	5.591	4.737	4.347	4.120	3.972	3.866	3.787	3.726	3.677	3.637
8	5.318	4.459	4.066	3.838	3.687	3.581	3.500	3.438	3.388	3.347
9	5.117	4.256	3.863	3.633	3.482	3.374	3.293	3.230	3.179	3.137
10	4.965	4.103	3.708	3.478	3.326	3.217	3.135	3.072	3.020	2.978
11	4.844	3.982	3.587	3.357	3.204	3.095	3.012	2.948	2.896	2.854
12	4.747	3.885	3.490	3.259	3.106	2.996	2.913	2.849	2.796	2.753
13	4.667	3.806	3.411	3.179	3.025	2.915	2.832	2.767	2.714	2.671
14	4.600	3.739	3.344	3.112	2.958	2.848	2.764	2.699	2.646	2.602
15	4.543	3.682	3.287	3.056	2.901	2.790	2.707	2.641	2.588	2.544
16	4.494	3.634	3.239	3.007	2.852	2.741	2.657	2.591	2.538	2.494
17	4.451	3.592	3.197	2.965	2.810	2.699	2.614	2.548	2.494	2.450
18	4.414	3.555	3.160	2.928	2.773	2.661	2.577	2.510	2.456	2.412
19	4.381	3.522	3.127	2.895	2.740	2.628	2.544	2.477	2.423	2.378
20	4.351	3.493	3.098	2.866	2.711	2.599	2.514	2.447	2.393	2.348

Chi-square statistical table

	Probability							
n	*.50*	*.30*	*.20*	*.10*	*.05*	*.02*	*.01*	*.001*
1	0.455	1.074	1.642	2.706	3.841	5.41 2	6.635	10.827
2	1.386	2.408	3.219	4.605	5.991	7.824	9.210	13.815
3	2.366	3.665	4.642	6.251	7.815	9.837	11.345	16.266
4	3 357	4.878	5.989	7.779	9.488	11.668	13.277	18.467
5	4 351	6.064	7.289	9.236	11.070	13.388	15.086	20.515
6	5.348	7.231	8.558	10.645	12.592	15.033	16.812	22.457
7	6.346	8.383	9.803	12.017	14.067	16.622	18.475	24.322
8	7.344	9.524	11.030	13.362	15.507	18.168	20.090	26.125
9	8 343	10.656	12.242	14.684	16.919	19.679	21.666	27.877
10	9 342	11.781	13.442	15.987	18.307	21.161	23.209	29.588
11	10.341	12.899	14.631	17.275	19.675	22.618	24.725	31.264
12	11.340	14.011	15.812	18.549	21.026	24.054	26.217	32.909
13	12.340	15.119	16.985	19.812	22.3622	5.472	27.688	34.528
14	13 339	16.222	18.151	21.064	23.685	26.873	29.141	36.123
15	14 339	17.322	19.311	22.307	24.996	28.259	30.578	37.697

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGN 2212 – PRINCIPLES OF HUMAN NUTRITION

Time Allowed: Three hours. **Total Marks: 100**

Date: Monday, 13th November 2023 **Time: 09:00 – 12:00hrs**

Instructions

1. The examination paper has two sections.
2. Section A is **compulsory** and
3. Section B has five (5) questions. Answer **any four (4)** questions in section B.
4. You are required to answer a total of five (5) questions.
5. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Section A

Question 1

Water balance, electrolyte balance and acid-base balance

a) Define body water balance and explain any **three (3)** functions of body water. **(5 marks)**

b) Give **two (2)** reasons why infants need more water. **(2 marks)**

c) Explain why it is important for the amount of water intake to equal the amount of water eliminated. **(3 marks)**

d) Define acid-base balance. Identify **two (2)** factors that can contribute to disturbances in acid-base balance. **(3 Marks)**

e) List **four (4)** body organs or systems that are involved in water and electrolyte balance. **(2marks)**

Question 2

Alcoholic beverages have been a distinctive component of many cultures for thousands of years.

a) List **two (2)** different types of alcoholic beverages. **(1 mark)**

b) Explain why once alcohol is in your system, your body makes metabolizing it a priority. **(2 marks)**

c) Give **two (2)** consequences of excessive consumption of alcoholic beverages. **(2 marks)**

Section B

Question 1

Sepo is a student at the University of Zambia. As she is rushing for class in the morning, she quickly takes two slices of brown bread spread with two tablespoons of butter.

a) List **two (2)** macronutrients and give **two (2)** examples of micronutrients (list the specific micronutrient) that are likely to be found in the food that Sepo has consumed so far. **(2 Marks)**

b) Explain in detail the digestion, absorption and transport of **one (1)** of the macronutrients you have mentioned in part (1) a of section B. **(12 Marks)**

c) Gastric juice is composed of the following materials. Briefly explain the function each of the following constituents of gastric juice. **(6 Marks)**

i) Hydrochloric acid

ii) Enzymes

Question 2

a) Give a brief description of the foods below. For each one of these food components, briefly describe how frequent and long term intake of each of the following affects an individual's nutritional wellbeing. **(8 Marks)**

i) High fructose corn syrup

ii) Incomplete proteins

b) Sara has high blood pressure, is taking diuretics and has also been struggling with chronic diarrhoea for 2 months. Describe in detail how this condition is associated with serum levels of the following minerals. ***(12 marks)***

i) Calcium

ii) Potassium

iii) Magnesium

iv) Sodium

Question 3

a) List three (3) functions of the digestive tract **(3 Marks)**

b) List three (3) risk factors of mineral toxicity in human beings **(3 Marks)**

c) Complete the table below **(14 Marks)**

Condition	**Brief description**	**One (1) Nutrient associated with the condition**	**One (1) nutrition related recommendation to manage the condition**
i) Hemochromatosis			
ii) Wilsons disease			
iii) Selenosis			

Question 4

Grace is a 16 years old and lives in the rural community of Vubwi. She is currently 3 months pregnant and is being closely monitored by the medical practitioner after presenting with iron and iodine deficiency.

a) State **one (1)** factor that is likely to influence her dietary absorption of iron and iodine. Explain the relationship between her condition and absorption of the affected nutrients and the factor you have mentioned. **(6 Marks)**

b) Briefly explain how iodine deficiency can affect Grace and her unborn child in the long run. **(4 Marks)**

c) List **two (2)** dietary sources of goitrogens and **two (2)** dietary sources of phytates. Describe how long term intake of these materials can affect Grace and her unborn child. **(6 Marks)**

d) State and describe **two (2)** food preparation or processing techniques you would use to inactivate goitrogens and other mineral inhibitors in food products **(4 Marks)**

Question 5

a) Compare and contrast vitamins and minerals? **(4 Marks)**

b) Compare and contrast digestion, absorption and transport of Vitamin C and Vitamin A **(10 Marks)**

c) Briefly explain the association between diabetes type II and vitamin C deficiency. **(3 Marks)**

d) Briefly describe the difference between folate and folic acid. **(3 Marks)**

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGN 3222: HUMAN NUTRITION

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. There are Four (4) questions in this paper. Each question is worth 25 marks.
2. Answer **All** questions in this paper.
3. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

Question One **[25 marks]**

With regards to a named water-soluble vitamin, give a thorough breakdown of the following:

i. Dietary sources [5 marks]
ii. Bodily functions [5 marks]
iii. Deficiency [5 marks]
iv. Toxicity [5 marks]
v. Absorption and storage [5 marks]

Question Two **[25marks]**

a. What do the following terms mean in the context of infant and young child feeding?

i. Early initiation of breastfeeding [2 marks]
ii. Appropriate and timely complementary foods [2 marks]
iii. Responsive feeding [2 marks]
iv. Lactation and breastfeeding [2 marks]

b. Increasingly, breastfeeding advocates present breastfeeding as the best option for feeding babies. State two (2) disadvantages that artificial infant feeding poses on the mother, the infant, and the environment [6 marks]

c. State four (4) consequences of introducing foods to an infant earlier than the recommended time. [4 marks]

d. The terms growth and development in children are defined as ..... [2 marks]

e. Most breast-fed infants will have additional needs for _____, _____ and _____, _____ after _____ months of age. [5 marks]

Question Three **[25 marks]**

"Describe the changing nutritional requirements in adults and older adults across the adult life stage. Discuss the key nutrients, their roles, and how dietary recommendations evolve with age. Include factors that affect nutrition in older adults and any potential challenges they may face in meeting their nutritional needs."

Question Four **[25 marks]**

The information in the table below represents the composition of general rations distributed to refugee populations in Mantapala, Zambia, and Kosovor, Macedonia. Answer the questions that follow:

Mantapala Refugee Camp (grams/person/day):	Kosovor, Macedonia, Refugee Camp (grams/person/day):
• Maize grain: 328	• Wheat flour: 350
• Beans: 96	• Rice/pasta: 100
• Oil: 16	• Beans: 30
• Corn soy blend (CSB): 32	• Meat/fish: 30
• Salt: 8	• Oil: 35
	• Sugar: 10
	• Salt: 5
	• Fruit/vegetable: 300
	• Cheese: 33
	• Milk: 300

i. i. Analyze and comment on the composition of the two rations in terms of their nutritional value and variety. [5 marks]

ii. Calculate the iron, energy, vitamin C, and protein content of the Mantapala ration using the attached Food composition tables. [10marks]

iii. Discuss the potential health consequences that the people of Mantapala are likely to suffer if they continue to receive only this ration and nothing else. [5marks]

iv. State five (5) significant reasons why countries should have their own food composition data tables [5marks]

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

Composition per 100 grams edible portion

Food Item	Energy (Kcal)	Protein (g)	Iron (mg)	Vitamin C (mg)
Maize grain	365	9.4	4.1	0
Wheat flour	332	10.3	3.6	0
Beans	335	22.5	6.2	4.2
Rice/pasta	130	2.7	0.8	0
Oil	884	0	0	0
Corn soy blend (CSB)	339	12.5	4.3	1.7
Salt	0	0	0	0
Sugar	387	0	0	0
Fruit/vegetable	35	0.9	0.3	8
Meat/fish	143	27.3	2.1	0
Cheese	402	25	0.2	0
Milk	42	3.4	0.03	0

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGN 4122: NUTRIENT AND DRUG INTERACTION

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has two sections.
2. Section A should be answered in this paper, Section B should be answered in a booklet
3. Write your Computer number on each answer sheet.
4. Write in a legible handwriting.

DO NOT TURN OVER UNTIL YOU ARE INSTRUCTED

SECTION A: MULTIPLE CHOICE **[30 marks]**

CIRCLE THE CORRECT ANSWER FROM THE OPTION PROVIDED

1. The following factors should be considered when assessing the possibility of food-drug interactions in a patient.
    a) Administered Medicines
    b) Illness of the patient
    c) Age of the patient
    d) Life Style of the patient
    e) All of the above
    f) None of the above

2. Which of the following are the risk factors for Drug – Nutrient interactions
    a) Impaired Renal system
    b) Impaired Hepatic System
    c) Dehydration
    d) Prolong Drug Use
    e) All of the above
    f) None of the above

3. Drugs with ENHANCED bioavailability in the presence of Food, except.
    a) Nitrofurantoin
    b) Griseofulvin
    c) Penicillins
    d) Carbamazepine
    e) All of the above
    f) None of the above

4. Drugs with REDUCED bioavailability in the presence Food, except.
    a) Tetracyclines
    b) Warfarin
    c) Theophylline
    d) Chloroquine
    e) All of the above
    f) None of the above

5. When taking an ACE inhibitor, such as captopril, avoid excessive amounts of potassium, found in:
    a) Bananas
    b) green leafy vegetables
    c) Oranges
    d) Mushrooms
    e) All of the above
    f) None of the above

6. Avoid this flavor of juice when using blood thinners (anticoagulants) such as warfarin:
    a) Apple
    b) Pineapple
    c) Orange
    d) Cranberry
    e) All of the above
    f) None of the above

7. Low serum Albumin (Hypoalbuminemia) concentration results in clinically significant decrease of drug binding sites. This may increase the free fraction of highly protein bound and cause toxicity. Give an example of a drug that can be affected in this manner.
    a) Warfarin
    b) Paracetamol
    c) Fluconazole
    d) Amoxicillin
    e) All of the above
    f) None of the above

8. The following drug factors can modify nutritional status of person, except
    a) Dose of a drug
    b) Duration of Treatment
    c) Drug combination used in therapy
    d) Source of the drug
    e) All of the above
    f) None of the above

9. You should avoid grapefruit juice if you are taking this cholesterol-lowering medication.
    a) Metformin
    b) Simvastatin
    c) Acetaminophen
    d) Omeprazole
    e) All of the above
    f) None of the above

10. If you are taking digoxin for the treatment of heart failure, you must avoid this glycyrrhiza-containing food.
    a) Orange Juice
    b) Lunch Meats
    c) Natural Black Licorice
    d) Hot Dogs
    e) All of the above
    f) None of the above

11. People being treated for depression with MAOIs should avoid aged cheese and chocolate because they contain this amino acid.
    a) Tyramine
    b) Threonine
    c) Glutamine
    d) Cysteine
    e) All of the above
    f) None of the above

12. The following drugs are recommended to be taken with food to maximize absorption except
    a) Albendazole
    b) Amiodarone
    c) Griseofulvin
    d) Ciprofloxacin
    e) All of the above
    f) None of the above

13. The following drugs should NOT be taken with food to allow optimal absorption except
    a) Ampicillin
    b) Isoniazid
    c) Norfloxacin
    d) Hydralazine
    e) All of the above
    f) None of the above

14. Which class of drugs cause hypokalemia as result of loss of K(Potassium)
    a) Loop Diuretics
    b) Statins
    c) Acetaminophen
    d) Tetracyclines
    e) All of the above
    f) None of the above

15. Which of the following factors can influence the bioavailability of Drugs/Nutrients?
    a) Altering the luminal PH
    b) Gastric emptying rate
    c) Intestinal transit time
    d) Chemical Interaction
    e) All of the above
    f) None of the above

16. The most appropriate laboratory test to monitor a patient with diabetes mellitus?
    a) Hgb A1c
    b) D-dimer
    c) Alkaline phosphate
    d) C-reactive protein Tyramine
    e) All of the above
    f) None of the above

17. The following are nutrition therapy goals in managing Gastro-esophageal Reflux Disease, except.
    a) Avoid Alcohol
    b) Avoid Spicy Foods
    c) Limit Fat Intake
    d) Eating Chocolate and Caffeine
    e) All of the above
    f) None of the above

18. In Peptic Ulcer disease, the following are true.
    a) Encourage the intake of coffee
    b) Eat an hour before bed time
    c) Pain killer such NSAIDs are the drug of choice for pain relief
    d) Does not interfere with the absorption of Vitamin C
    e) All of the above
    f) None of the above

19. Which drug can lead to serious kidney injury in patients with poor nutrition and alcoholics?
    a) Paracetamol
    b) Ibuprofen
    c) Warfarin
    d) Aspirin
    e) All of the above
    f) None of the above

20. Which of the following Anti-Tuberculosis drugs interferes with the metabolism of Vitamin B6?
    a) Rifampicin
    b) Isoniazid
    c) Pyrazinamide
    d) Streptomycin
    e) All of the above
    f) None of the above

21. Escherichia and Salmonella are associated with
    a) Food allergy
    b) Food probiotics
    c) Food poisoning
    d) Food prebiotics
    e) All of the above
    f) None of the above

22. Antioxidant nutrients and phytochemicals that may provide a medical or health benefit are referred to collectively, as
    a) Pharmaceuticals.
    b) Nutraceuticals
    c) Saturated fats
    d) Enzymes
    e) All of the above
    f) None of the above

23. One of the most common food-drug interaction regarding Warfarin occurs with Green leafy Vegetables such as Broccoli, Lettuce due to their rich Vitamin K content. This is because
    a) Vitamin K leads to an increase in clotting factors
    b) Vitamin K leads to a decrease in clotting factors
    c) Vitamin K decreases the metabolism of warfarin
    d) Vitamin K increases the metabolism of Warfarin
    e) All of the above
    f) None of the above

24. Which class of drugs can result in a hypertensive crisis also known cheese/tyramine reaction when co-ingested with tyramine rich food
    a) Monoamine Oxidase Inhibitors (MAOIs)
    b) Analgesics
    c) Antiobitics
    d) Antihypentensives
    e) All of the above
    f) None of the above

25. A person who has had a renal transplant should regulate the intake of _____
    a) Carbohydrates
    b) Proteins
    c) Fats
    d) Vitamins
    e) All of the above
    f) None of the above

26. A person who is suffering from high blood pressure should cut down on _____
    a) potassium
    b) calcium
    c) magnesium
    d) Sodium
    e) All of the above
    f) None of the above

27. Which of the following statements is TRUE regarding probiotics?
    a) Probiotics are organisms that contribute toward intestinal microbial balance
    b) Probiotics are non-digestible food products that selectively stimulates the growth of one or a limited number of bacteria in the colon to confer health benefit for the host
    c) There is good evidence to suggest that probiotics have a beneficial role in preventing post-operative recurrence of Crohn's Disease
    d) Probiotic consists of strains of lactobacillus, bifidobacterium and Saccharomyces boulardi
    e) All of the above
    f) None of the above

28. What is the definition of a dietary supplement?
    a) Those that contain ergogenic substance
    b) Those that are not regulated by law
    c) Those that contain at least 1 of these: vitamin, mineral, herb, botanical, amino acid, metabolite, extract of a plant
    d) Those that contain ingredients that have been scientifically proven to have the effect that the manufacturer states on the label
    e) All of the above
    f) None of the above

29. Which of the following is the best source for omega 3 fatty acids?
    a) Corn oil
    b) Wheat products
    c) Pork
    d) Sardines
    e) All of the above
    f) None of the above

30. Long periods of parenteral nutrition may not recommended because of _____
    a) It increases the toxicity of blood
    b) It puts pressure on the kidney
    c) It puts pressure on the heart
    d) It causes the GI track to degenerate
    e) All of the above
    f) None of the above

31. All of the following statements about antacid are true, Except:
    a) Weak bases that neutralize gastric pH
    b) Inhibits the formation of pepsin
    c) Aluminum antacids cause diarrhea and magnesium antacids cause constipation
    d) Aluminum antacids cause constipation and magnesium antacids cause diarrhea
    e) All of the above
    f) None of the above

32. The following antiemetic act by blocking D2 receptor in the CTZ:
    a) Metoclopramide
    b) Cisapride
    c) Chlorpromazine
    d) Domperidone
    e) All of the above
    f) None of the above

33.....interferes with most of the CYP450 enzymes and thus leads to many drug interactions.
    a) Famotidine
    b) Omeprazole
    c) Ondansetron
    d) Cimetidine
    e) All of the above
    f) None of the above

34. Which of the following laxatives lowers blood ammonia levels in hepatic encephalopathy?
    a) Lactulose
    b) Liquid paraffin
    c) Magnesium sulfate
    d) Bisacodyl
    e) All of the above
    f) None of the above

35. Choose an emetic drug of central action:
    a)Ipecacuanha derivatives
    b)Promethazine
    c)Tropisetron
    d)Apomorphine hydrochloride
    e) All of the above
    f) None of the above

36. Tick the mechanism of Metoclopramide antiemetic action:
    a)H1 and H2-receptor blocking effect
    b)M-cholinoreceptor stimulating effect
    c)D2-dopamine and 5-HT3-serotonin receptor blocking effect
    d)M-cholinoblocking effect
    e) All of the above
    f) None of the above

37. Select the emetic agent having a reflex action:
a) Ipecacuanha derivatives
b) Apomorphine hydroclorid
c) Chlorpromazine
d) Metoclopramide
e) All of the above
f) None of the above

38. All of the following drugs are antiemetics EXCEPT:
a) Metoclopramide
b) Ondansetron
c) Chlorpromazine
d) Apomorphine hydrochloride
e) All of the above
f) None of the above

39. Indicate an antiemetic agent which is related to neuroleptics:
a) Metoclopramide
b) Nabilone
c) Tropisetron
d) Prochlorperazine
e) All of the above
f) None of the above

40. All of these drugs reduce intestinal peristalsis EXCEPT:
a) Loperamide
b) Cisapride
c) Methyl cellulose
d) Magnesium aluminium silicate
e) All of the above
f) None of the above

41. Indicate the laxative drug belonging to osmotic laxatives:
a) Docusate sodium
b) Bisacodyl
c) Phenolphthalein
d) Sodium phosphate
e) All of the above
f) None of the above

42. The mechanism of stimulant purgatives is:
a) Increasing the volume of non-absorbable solid residue
b) Increasing motility and secretion
c) Altering the consistency of the feces
d) Increasing the water content
e) All of the above
f) None of the above

45. The following are excipients, EXCEPT:
a) Suspending agents,
b) buffers,
c) binders
d) Active ingredients
e) All of the above
f) None of the above

46. For Nutrition Assessment Anthropometric data include the following: EXCEPT
    a) Related to physical measurements of the human body
    b) Head circumstances
    c) Height
    d) Biochemical Analyses
    e) All of the above
    f) None of the above

47. Give the definition for a therapeutical dose:
    a) The amount of a substance to produce the minimal biological effect
    b) The amount of a substance to produce effects hazardous for an organism
    c) The amount of a substance to produce the required effect in most patients
    d) The amount of a substance to accelerate an increase of concentration of medicine in an organism
    e) All of the above
    f) None of the above

48. Pick out the correct definition of a toxic dose:
    a) The amount of substance to produce the minimal biological effect
    b) The amount of substance to produce effects hazardous for an organism
    c) The amount of substance to produce the necessary effect in most of patients
    d) The amount of substance to fast creation of high concentration of medicine in an organism
    e) All of the above
    f) None of the above

49. What is the type of drug-to-drug interaction which is the result of interaction at receptor, cell, enzyme or organ level?
    a) Pharmacodynamic interaction
    b) Physical and chemical interaction
    c) Pharmaceutical interaction
    d) Pharmacokinetic interaction
    e) All of the above
    f) None of the above

50. What phenomenon can occur in case of using a combination of drugs?
    a) Tolerance
    b) Tachyphylaxis
    c) Accumulation
    d) Synergism
    e) All of the above
    f) None of the above

51. A teratogenic action is:
    a) Toxic action on the liver
    b) Negative action on the fetus causing fetal malformation
    c) Toxic action on blood system
    d) Toxic action on kidneys
    e) All of the above
    f) None of the above

52. Characteristic unwanted reaction which isn't related to a dose or to a pharmacodynamic property of a drug is called:
    a) Idiosyncrasy
    b) Hypersensitivity
    c) Tolerance
    d) Teratogenic action

53. Pharmacokinetics is:
    a) The study of biological and therapeutic effects of drugs
    b) The study of absorption, distribution, metabolism and excretion of drugs
    c) The study of mechanisms of drug action
    d) The study of methods of new drug development

54. What does the term "bioavailability" mean?
    a) Plasma protein binding degree of substance
    b) Permeability through the brain-blood barrier
    c) Fraction of an uncharged drug reaching the systemic circulation following any route administration
    d) Amount of a substance in urine relative to the initial doze

55. The following factors should be considered when assessing the possibility of food-drug interactions in a patient.
    a) Administered Medicines
    b) Illness of the patient
    c) Age of the patient
    d) All of the above

56. According to Paracelsus (1493-1541), Food or drugs can be poisonous, however it mainly depends on;
    a) Dose
    b) Quality
    c) Population
    d) Environment

57. Which is the most relevant and used classification for drugs?
    a) Pharmacological classification
    b) Alphabetical Classification
    c) Numerical classification
    d) Morphological classification

58. The following are Symptoms of Dyspesia: EXCEPT
    a) Early satiation
    b) Bloating
    c) Heartburn
    d) Diarrhoea

59. The most suitable laxative for a patient of irritable bowel syndrome with spastic constipation is
    (a) Dietary fibre
    (b) Liquid paraffin
    (c) Bisacodyl
    (d) Senna

60. Antimotility drugs are contraindicated in
    (a) Mild traveler's diarrhoea
    (b) Acute infective diarrhoeas
    (c) Ileostomy patients
    (d) Patients after anal surgery

SECTION B

ANSWER ONLY TWO QUESTIONS FROM THIS SECTION

QUESTION 1 [20 marks]

a) Compare and contrast Pharmacokinetics and Nutrient kinetics [4 Marks]

b) Define Pharmacodynamics and Bioavailability [4 Marks]

c) Explain with examples how food can influence the bioavailability of drugs by

i. Formation of complexes [4 Marks]

ii. Alteration of the luminal PH [4 Marks]

d) Mention at least two United Nation Sustainable Development Goals (SDGs) that are aimed at improving Nutrition globally [4 Marks]

QUESTION 2

a) Explain with examples how the presence of food in the stomach decreases the extent of drug absorption [5 Marks]

b) Explain with examples how the presence of food in the stomach enhances the extent of absorption of drugs [5 Marks]

c) Demonstrate how an illness can affect the nutrition status of a patient [5 Marks]

d) List four benefits of minimising food-drug interactions. [5 Marks]

QUESTION 3

a) Define excipients and give 2 examples [4 Marks]

b) What is celiac disease? [2 Marks]

c) Compare and contrast Enteral and parental Nutrition [4 Marks]

d) List at least one indication and contra-indication for Enteral and parental feeding respectively [4 Marks]

e) List four adverse effects of food-drug interactions. [4 Marks]

f) Define Nutraceuticals. [2 Marks]

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGS 2110: FUNDAMENTALS OF SOIL SCIENCE

Time Allowed: Three hours. **Total Marks: 100**

Instructions:

1. The examination paper has three sections (A, B and C).
2. Sections A and B are **compulsory** and
3. Section C has two questions. Answer **any one** questions in section C.
4. You are required to answer a total of five (5) questions.
5. Write in a legible handwriting.

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SECTION A: Answer all Questions: (35 marks)

1 Define the following terms: **(15 marks)**

a. Pedology
b. Physical weathering
c. Hardness of a mineral
d. Soil particle density
e. Humus
f. Gellisols
g. Topo sequence
h. Mineralization of nutrients
i. Soil biomass
j. Effective cation exchange capacity

2. Indicate whether the following statements are True or False. **(20 marks)**

a. A soil profile containing A, B and C horizons is younger in terms of soil development than one containing O, A and C horizons.
b. A sodic soil is likely to have a higher aggregate instability index than an acid soil with a high aluminium saturation.
c. The active acidity of an acid soil is usually much greater than its reserve acidity.
d. Water held between sand grains is more readily available for plant uptake than water held between clay particles.
e. More energy is required to extract a kilogram of water from soil pores with a diameter of 20 μm than to extract a kilogram of pure water from a 0.001m NaCl aqueous solution at 25° C.
f. A clay dominated by montmorillonite with a CEC of 80 cmol (+)/kg is likely to disperse more readily than a clay dominated by kaolinite clay with a CEC of 10 cmol (+)/kg when both placed in a very dilute aqueous solution dominated by sodium ions.
g. Conglomerates are metamorphic rocks
h. During the formation of igneous rocks from magma, olivine forms earlier than biotite.
i. Saturated soils always have a matric potential of zero.
j. A soil with an Udic moisture regime occurs in a wetter region than one with an Ustic moisture regime.
k. Mottling in soils is an indicator of the occurrence of oxygen deficiency in the soil at some time during the year.
l. A soil with 0.15 cmol(+) K/kg contains more K than a soil with 50 mg exchangeable K/kg.
m. A 100 cm^3 of soil with a particle density of 2. 65$g.cm^{-3}$ and dry bulk density of 1. 36$g.cm^{-3}$ will not weigh more than 200 grams when saturated with water.
n. Between the colour codes 5YR4/6 and 5YR 4/8 determined on the same soil sample, the first colour code is more likely represents the colour of moist soil sample while the second likely represents that of the dry soil.

o. Nitrogen, calcium, sodium and potassium are plant micronutrients.
p. Dispersion of soil colloids is favoured by the presence of thin diffuse double layer around the colloids.

SECTION B: Answer all Questions: (35 marks)

3. The principle of liming an acid soil is to displace hydrogen ions from the cation exchange sites and then neutralize the displaced hydrogen using suitable alkaline materials. Answer the questions below: **[16 marks]**

   a. Using a balanced chemical equation, show how the auto ionization of water contributes to soil acidification. [2 marks]

   b. List any four (4) liming materials. [4 marks]

   c. Calculate the lime requirement in kilograms of pure calcium carbonate per hectare of land with a soil depth of 20 cm, a dry bulk density of 1.48 $g.cm^{-3}$, exchangeable acidity of 1.2 cmol (+).kg^{-1}, and ECEC of 6.5 cmol (+).kg^{-1}. [5 marks]

   d. Calculate the lime requirements of the soil in question 3c above in kg/ha for liming materials A and B with neutralizing values of 135 and 109 %, respectively. [3 marks]

   e. Calculate the effective neutralizing values of liming materials A and B in question 3d above if both have a fineness factor of 0.9. [2 marks]

4. A farmer who wants to grow groundnuts on a hectare of land collects a representative soil sample from the top 20 cm depth and takes it for laboratory analysis. The recommendation given is to supply the crop with a minimum of 20 kg of nitrogen/ha and 26.2 kg of phosphorus/ha. Answer the following questions: **(19 marks)**

   a. Would 200 kg of mono-ammonium phosphate (MAP) fertilizer (11-52-0) /ha supply the recommended amounts of nitrogen and phosphorus? Show calculations to support your answer. [6 marks]

   b. How many kilograms of triple super phosphate (TSP) fertilizer (0-46-0) are required to supply 26.2 kg of phosphorus? [4 marks]

   c. How many kilograms of Urea (46-0-0) are needed to supply 20 kg of nitrogen? [3 marks]

   d. Without considering their nitrogen contents, which fertilizer would you recommend for use on an acidic soil between Urea (46-0-0) and calcium ammonium nitrate (CAN) (27-0-0 + 8 % Ca)? Give reasons to support your answer. [2 marks]

   e. Indicate whether MAP, TSP, Urea and CAN are Compound or Straight fertilizers. Give reasons to support your answer [4 marks]

SECTION C: Answer One Question Only (1) (30 marks)

5. Answer the following questions briefly **(30 marks)**

a. A soil profile has the following horizons Cg, R, O, A, Bt1 Bt2g. Sketch a profile of this soil, indicating the order in which the soil horizons occur beginning with the one at the surface to the one at the bottom. Indicate the solum in the soil profile. (5 marks)

b. Write a balance chemical weathering reaction of muscovite ($KAl_2(Si_3Al)\ O_{10}\ (OH)_2$ to form the clay mineral kaolinite $Al_2Si_2O_5(OH)_4$ by carbonation and indicate whether this is an example of congruent or incongruent weathering. (5 marks)

c. A soil horizon has been described below as:

10 -30 cm *Red (2.5YR4/6 moist) clay loam, weak fine subangular blocky, hard (dry), friable (moist), sticky and plastic.*

Answer the following questions: (5 marks)

i. List all the properties of the soil included in the above description. (2.5 marks)
ii. Is the above a surface or subsurface horizon? Give reason to support your answer. (1.5 marks)
iii. Is the above horizon well drained or poorly drained? Give reasons to support your answer. (1 marks)

d. List any six nutrients, indicate their chemical symbol and whether they are macronutrients and micronutrients. (5 marks)

e. List the six levels used to classify soils in the USDA soil classification system and indicate any six soil orders in this classification system. (5 marks)

f. During the determination of the particle size distribution of a soil, a soil particle takes 2 hours to settle through a depth of 0.10 m in a dispersed soil suspension. If the viscosity of water is 0.001 $Nm^{-1}.\ s^{-2}$, the particle density is 2700 $kg.m^{-3}$, the density of water is 1000 $kg.m^{-3}$ and the acceleration due to gravity is 9.8 m. s^{-2}, calculate the diameter of the soil particle and indicate the size fraction to which it belongs. (5 marks)

The formula for terminal velocity settling of a spherical particle in a fluid under laminar flow is: $V= d^2g(\rho s-\rho f)/18\eta$.

where: V=settling velocity of particle ($m.s^{-1}$), g=acceleration due to gravity ($m.s^{-2}$), d= spherical diameter of particle (m), η= viscosity of fluid ($kg.m^{-1}.s^{-1}$), ρ_s= particle density ($kg.m^{-3}$), ρ_f= density of fluid ($kg.m^{-3}$)

6. Selected properties of surface horizon of a field are summarized in the Table below.

Depth	Bd	pH	Al^{3+}	Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}	θgFC	θgPWP
cm	g/cm^3	$0.01MCaCl_2$	cmol(+)/kg					%	
0-20	1.54	4.8	0.7	8.0	0.4	0.2	0.2	10.8	5.0

If the particle density of the soil is $2.65g/cm^3$, answer the following questions. **(30 marks)**

a. What is the active acidity of this soil in moles H^+/ L? (2 marks)

b. Calculate the aluminium saturation and the percent base saturation of this soil (4 marks)

c. Is this soil wet, moist, or dry when its gravimetric moisture content is 6.5 %? Give reasons to support your answer. (2 marks)

d. What percentage of the total volume of the soil is occupied by air when the soil is at Field Capacity? (4 marks)

e. How many millimeters of water are required to wet the whole soil horizon if the initial gravimetric moisture content of the soil is 3 %? (5 marks)

f. How many cubic metres of plant available water are present in 1 ha of this horizon when the gravimetric moisture content is 7.5%? (4 marks)

g. If 6 hours after a rainfall event, the diameter of the largest pores filled with water at surface of the soil horizon is 24 μm, while bottom of the soil horizon is at Field Capacity and the soil at the bottom is undisturbed, answer the following:

(i) Calculate the hydraulic heads H (in m) at the surface and bottom of the soil horizon using the bottom of the soil horizon as the reference level for the gravitational potential. (5.0 marks)

(ii) In which direction will water flow between the surface and bottom of the horizon. Give reasons to support your answer (2 marks)

(iii) What class or classes of soil pores are filled with air when the soil it is at field capacity? Show calculations to support your answer. (2.5 marks)

Useful Data:

R= 8.3145 J/mol/k. K = (°C +273.15), Mw= 0.018kg/mol. **Atomic masses**: Ca=40g, K=39g, P=31g, Al=27g, S =32g, Si=28g O=16 g, C=12g, H=1 g

END OF EXAMINATION

SOIL SCIENCE IS FUN

THE UNIVERSITY OF ZAMBIA
NOVEMBER END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGS 2142: LAND USE PLANNING

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. Answer all questions.
2. Write in a legible handwriting.

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1. With the aid of a well-illustrated diagram explain the place of land evaluation in land use planning. [15 marks]
2. What would you use to develop benchmarks before formulating alternative land use plans? [15 marks]
3. With a suitable example based on Land Utilization Type from the crops section of the UNZA field station, explain how land qualities can be used as diagnostic criteria to establish land suitability for a specific land utilization type. [25 marks]
4. Given that you are to undertake a feasibility study on soybean suitability in Kabwe district of Zambia. You have identified accessibility as one of the key land use requirements. What would be your source of information on accessibility and how would you go about rating it? [15 marks]
5. What are the differences between coercive and interactive approach in community based management? [15 marks]
6. Why is slope included as a LUR for most crops grown under irrigation? [15 marks]

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

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTUTRAL SCIENCES
DEPARTMENT OF SOIL SCIENCE
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGS 2642: INTRODUCTORY LAND HUSBANDRY

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. Answer all questions
2. Write in a legible handwriting.

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Question One [5 marks]

Distinguish between the following terms:

a. Soil and land **[2 marks]**
b. Land degradation and land husbandry **[3 marks]**

Question Two [35 marks]

a. Discuss the three (3) untapped resources in alleviation of land degradation **[10 marks]**

b. What characteristics are associated with low soil fertility status and suggest measures to alleviate each one of them **[10 marks]**

c. Give a detailed presentation of the properties you would consider in the assessment of soil physical fertility **[10 marks]**

d. Give a justification for focusing on the farm household in the promotion of Good land husbandry practices **[5 marks]**

Question Three [15 marks]

Explain each of the following terms, emphasizing on their usefulness for sustainable agriculture [15 marks]

a. Minimum tillage
b. Conservation agriculture
c. Crop management factor
d. Lablab
e. Faidherbia albida

Question Four [10 marks]

Faidherbia Albida is known to under goes reverse phenology. Answer the following questions

a. Explain the term reverse phenology? **[2 marks]**
b. What are the 5 advantages of Faidherbia Albida in agricultural fields? **[4 marks]**
c. Explain how having Faidherbia Albida in agricultural fields would help mitigate the effects of climate change? **[4 marks]**

Question Five [10 marks]

Fifty six (56) bags of Uniturtle lime with an effective neutralizing value of 85.5% were recommended for liming a certain farm in Lusaka West. Given that the depth of soil sampling was 20cm and a bulk density of 1500kg/m3. Answer the following questions;

i. Estimate the exchangeable aluminium of the soil? **[5 Marks]**
ii. Given that the CEC of the soil is 2.2 cmol $(+)$/kg soil, estimate the aluminium saturation percent? **[2 Marks]**
iii. When is this approach of lime recommendation appropriate? **[3 Marks]**

Question Six [10 marks]

During an erosion experiment at the field station, the following data was collected based on the standard plot. Answer the following questions.

Parameters	**Bare plot**	**velvet bean plot**
Soil collected (g)	7	2
Runoff collected (m3)	52	12
Time taken to collect (minutes)	2	12

a. Estimate the soil loss in t/ha/year for the bare plot? **[3 marks]**
b. Estimate the soil loss in t/ha/year for the velvet beans plot? **[3 marks]**
c. What could explain the higher soil loss in the bare plot compared to the velvet bean plot? **[2 marks]**
d. Estimate the crop management factor? **[2 marks]**
e. What would be your advice to smallholder farmers based on this experiment? **[2 marks]**

Question Seven [25 marks]

The rapid increase in population has exacerbated the demand for food and fuel worldwide exerting more pressure on land availability for agriculture thus causing use of mountainous lands which is prone to erosion. This land being proposed for crop production and house settlement has a length dimension of 300m with an erodibility of 0.3, the rainfall erosivity is 200, slope of 13% and assuming a bulk density 1.5ton/m^3: (Refer to Figure 1 attached)

a. Given that they are no crop management and erosion control processes being practiced, calculate the soil loss in tons/ha/year **[2 marks]**

b. Based on your answer in (a),

   i. calculate the depth of soil removed in cm by erosion per annum? **[2 marks]**

   ii. calculate the depth of soil removed in cm in a decade? [1marks]

c. Given that all the area would be planted with velvet velvet bean with a crop management practice of 0.2 and that the erosion control practice is 0.5, calculate the soil loss tons/ha/year? **[2 marks]**

d. Given that all the area would be planted with maize which has a crop management practice of 0.5 and that the erosion control practice is 0.5, calculate the soil loss in tons/ha/year? **[2 marks]**

e. Using answers to c and d, calculate the percentage reduction in soil loss if you chose the option that reduces soil erosion significantly? **[2 marks]**

f. Given that soil losses of 17 t/ha/year causes crop loss of 8% annually, state which crop will result in significant losses, given that yield of velvet beans and maize give that the actual yield are 3 and 5 t/ha respectively. **[3 marks]**

g. With the aid of a drawing, design 50 m terraces and calculate the soil that needs to be moved, given that the new slope is 8% and that $1m^3$=1.5ton. **[8 marks]**

h. What are the advantages and disadvantages of terracing **[2 marks]**

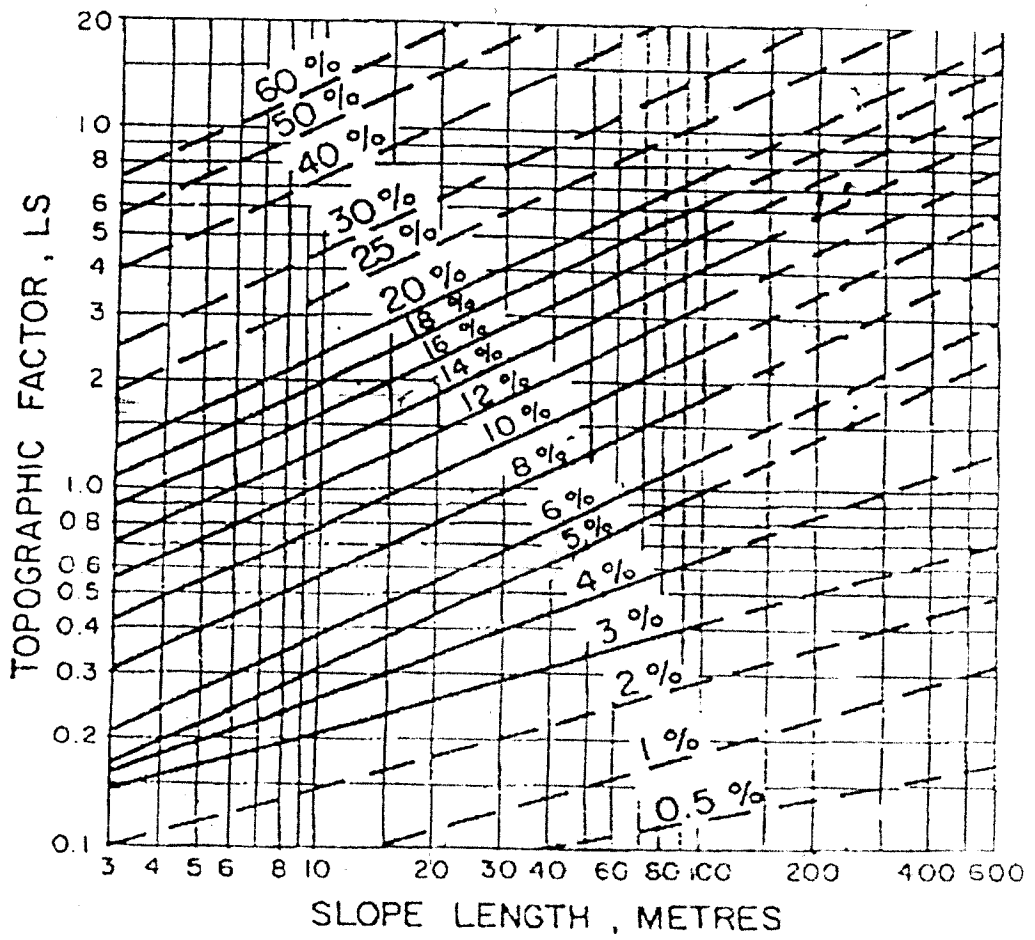

Figure 1: Relation between topographic factors LS and slope length

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

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
END OF YEAR EXAMINATIONS
2022/23 ACADEMIC YEAR

AGS 3312: SOIL PHYSICS

Time Allowed: Three hours. **Total Marks: 100**

Instructions

1. The examination paper has **two sections**
2. Section A is compulsory.
3. Answer **any three** questions in section B.
4. You are required to answer a total of **four (4)** questions.
5. Write in a legible handwriting.

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Section A

Question One [25 marks]

A soil profile in a rice field consists of an upper layer of 60 cm and a lower layer of 20 cm with hydraulic conductivities of 2.7×10^{-4} cm s^{-1} and 4.5×10^{-5} cm s^{-1}, respectively. If the water depth on the field is maintained constantly above the soil surface and the water discharge (Q) at the bottom layer of the soil profile is 1.2 cm^3 min^{-1} from a surface area of 20 cm^2:

a) Determine the amount of water required to maintain a constant water head at the soil surface in (*i*) *mm* day^{-1} and (*ii*) m^3 ha^{-1} day^{-1}

b) Determine the height of water on the soil surface required to maintain this constant water discharge above

c) Determine the soil water potentials (*z*, *h* and *H*) at (*i*) the bottom, (*ii*) interface between the two layers, (*iii*) interface with water and (*iv*) at the water surface

d) Draw the soil water potential (*z*, *h* and *H*) diagram

Section B

Question Two [15 marks]

Water flow in a soil media can be described by the following equation in its partial differential form:

$$\frac{\partial \theta}{\partial t} = K_x \cdot \frac{\partial^2 H}{\partial x^2} + K_y \cdot \frac{\partial^2 H}{\partial y^2} + K_z \cdot \frac{\partial^2 H}{\partial z^2}$$

a) Explain the different components in the equation above

b) Based on the above equation, write an equation describing:
   i) Saturated flow under anisotropic conditions
   ii) Unsaturated flow under isotropic conditions
   iii) Horizontal flow under unsaturated conditions

Question Three [15 marks]

Equilibrium soil wetness at any suction point is best illustrated by the phenomena of hysteresis. Highlight the factors responsible for hysteresis

Question Four [15 marks]

A given soil at Mansa sugar plantation (11° 56' 23" south; 28° 40' 52" east) in which the water is in equilibrium with the water table at 40 cm, is used to study water dynamics in space and time. Taking the reference at the water table, determine;

a. The potentials (gravitational (z), matric/pressure (h/p), total hydraulic head (H)) across the soil profile.

b. What is the importance of knowing the water potential in a given soil profile?

Question Five [15 marks]

What is a pF curve? What are the important points, worth noting about the pF curve?

Question Six [15 marks]

A cube of soil has sides 10 cm each, a total wet mass of 1800g, a dry mass of 1500 g, and held 0.3 kg of water when collected from the field. Assume the soil particle density is 2.65 gcm^{-3}. Determine the following;

1. gravimetric water content
2. volumetric water content
3. depth of water
4. depth of solids
5. depth of air
6. bulk density
7. porosity
8. aeration porosity
9. saturation water content
10. relative saturation

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