THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS - 2000/2001
FIRST SEMESTER
SCHOOL OF AGRICULTURE

1	AGA	211	-	Anatomy of farm Animals
2	AGA	211	-	Anatomy of farm Animals - sup
3	AGA	222	-	Physiology of farm Animals
4	AGA	311	-	Principles of Animal Nutrition
5	AGA	311	-	Principles of Animal Nutrition - sup
6	AGA	332	-	Applied Anim﹒ ﹒trition
7	AGA	332	-	Applied Animal Nutrition -Def
8	AGA	332	-	Applied Animal nutrition -Def
9	AGA	342	-	Basic Animal breeding and genetics
10	AGA	531	-	Topics in Animal Nutrition
11	AGA	542	-	Animal Health
12	AGA	552	-	Animal products and by-products
13	AGA	561	-	Aquaculture Genetics and health
14	AGA	562	-	Applied animal breeding
15	AGC	211	-	Fundamentals of crop science
16	AGC	322	-	Forage crop production and range management
17	AGC	332	-	Plant pathology
18	AGC	342/411	-	Field crop production
19	AGC	422	-	Horticultural science 1
20	AGC	431	-	Agricultural entomology
21	AGC	431	-	Agricultural entomology - Def/Sup
22	AGC	431	-	Agricultural entomology
23	AGC	442	-	Plant Breeding
24	AGC	511	-	
25	AGC	521	-	Plant Breeding II
26	AGC	552	-	Horticulture Science II
27	AGC	572	-	Post Harvest Technology
28	AGE	211	-	Fundamentals of Micro - Economics
29	AGE	222	-	Macro Economics
30	AGE	222	-	Macro economics - Sup
31	AGE	311	-	Rural Sociology
32	AGE	411	-	Introduction to Agribusiness Management
33	AGE	442	-	Introduction of Econometrics
34	AGE	452	-	Intermediate Agribusiness management
35	AGE	462	-	Agricultural Marketing and Pricing
36	AGE	541	-	Def/Sup

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36	AGE	541	-	Def/Sup

37	AGE	552	-	
38	AGE	562	-	Intermediate farm management
39	AGE	572	-	Agricultural policy
40	AGE	582	-	Project monitoring and Evaluation
41	AGF	211	-	General microbiology - theory
42	AGF	311	-	Chemical Techniques in food Analysis - Sup
43	AGG	311	-	Probability and statistics - Def/sup
44	AGS	322	-	Soil Physics
45	AGS	322	-	Soil Survey Techniques
46	AGS	411	-	Soil Fertility
47	AGS	422	-	Soil Microbiology
48	AGS	431	-	Soil mineralogy and micromophology
49	AGS	441	-	Agricultural hydrology and hydraulics
50	AGS	452	-	Principles of Land husbandry
51	AGS	462	-	Soil Physics for Agricultural Engineering
52	AGS	522	-	Soil and Plant Analysis
53	EA	415	-	Agricultural Mechanisation
54	EA	522	-	Farm Structures II
55	EA	542	-	irrigation Engineering
56	EC	935	-	Agricultural Economics

THE UNIVERSITY OF ZAMBIA

DEPARTMENT OF ANIMAL SCIENCES

ANATOMY OF FARM ANIMALS (AGA 211)

FIRST SEMESTER FINAL EXAMINATIONS (JANUARY 2001)

INSTRUCTIONS: Answer ALL Questions.

TIME ALLOWED :   3 HOURS

Q1.   (20 marks)
Refer to figure 1(a) and (b). The figure shows the genitalia of the bull.

(a)   Label the figure A through E for (a) and A through E for (b).
(b)   With reference to figure 1(a), what is the other term used for the part labelled B?
(c)   With reference to figure 1(a), what is the function of the part labelled A?
(d)   With reference to figure 1(a), what is the function of the part labelled D?
(e)   With reference to figure 1(b), briefly describe the function of the part labelled B.

Q2. (25 marks)
Figure 2 shows a sagittal section of the cow's udder.

(a)   Show on the diagram where the parenchyma (epithelical tissue) is.
(b)   Show on the diagram where the connective tissue (fat pad) is.
(c)   Draw a sketch showing the duct system beginning from the gland cistern.
(d)   Describe briefly the changes in the epithelial lining beginning from the surface of the teat all the way to the alveoli.
(e)   Write brief notes on the following:

(i)   Myoepithelical cells
(ii)   Lactiferous sinus
(iii) Stroma
(iv)   External pudendal artery

Q3. (25 marks)

(a)   Draw the adrenal gland and label the following parts:
- Capsule
- Zona glomerulosa
- Zona fasciculata
- Zona reticularis
- Medulla

(i)   Describe briefly the type of cells found in each layer of the cortex and the medulla.

(ii)   Name two hormones each, produced in the cortex and medulla.

(iii) What is the other term used for the adrenal glands?

(b)   Draw the structure of the thyroid gland and label the following:

- Follicular cells
- Parafollicular cells
- Interfollicular connective tissue
- Lumen containing colloid material.

(i)   Write short notes on Parafollicular cells.

(ii)   Mention two effects of thyroidectomy.

Q4 (12 marks)

There are over 200 different types of cells in the human body. These are assembled into a variety of different types of tissues, including Epithelial tissue and three other basic types.

(a)   Name the other three basic types of tissues.

(b)   Except for epithelial tissue, draw fully labelled cells for each of the tissues.

(c)   Draw the structure of the plasma membrane and label fully.

Q5. (18 marks)

Refer to Figure 3.

(a)   Label parts A through G.

(b)   Briefly describe the bones found in this structure.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
END OF EXAMINATION

THANK YOU SO MUCH FOR BEING WITH ME IN THE COURSE!

FIGURE 1

a)

Bladder

A

B

Retractor
Penis muscle

C

E

D

Testicle

b)

A

E

D

B

C

FIGURE 2

Blood supply

Gland cistern

Teat cistern

Streak canal

FIGURE 3

A

B

C

D
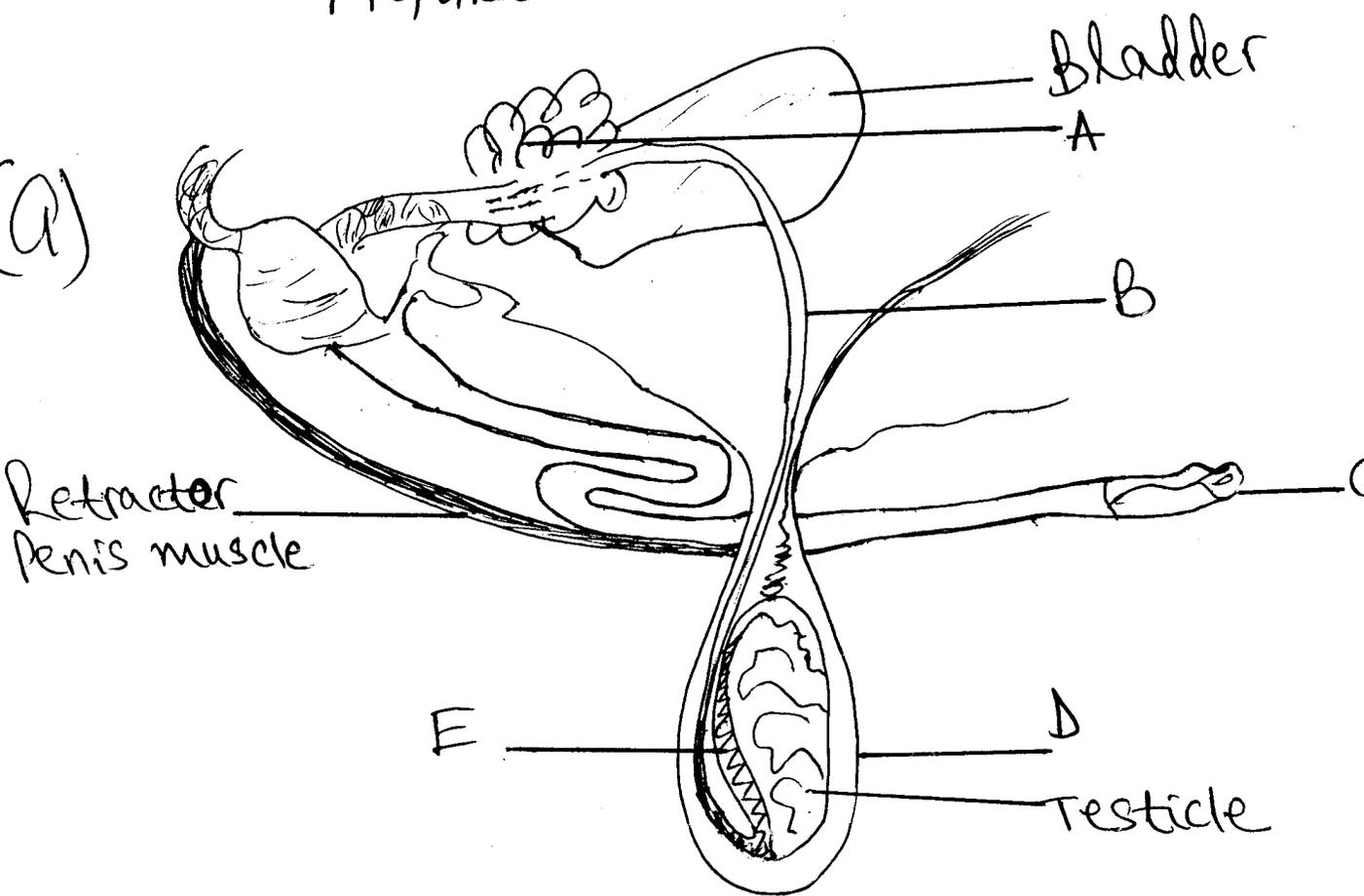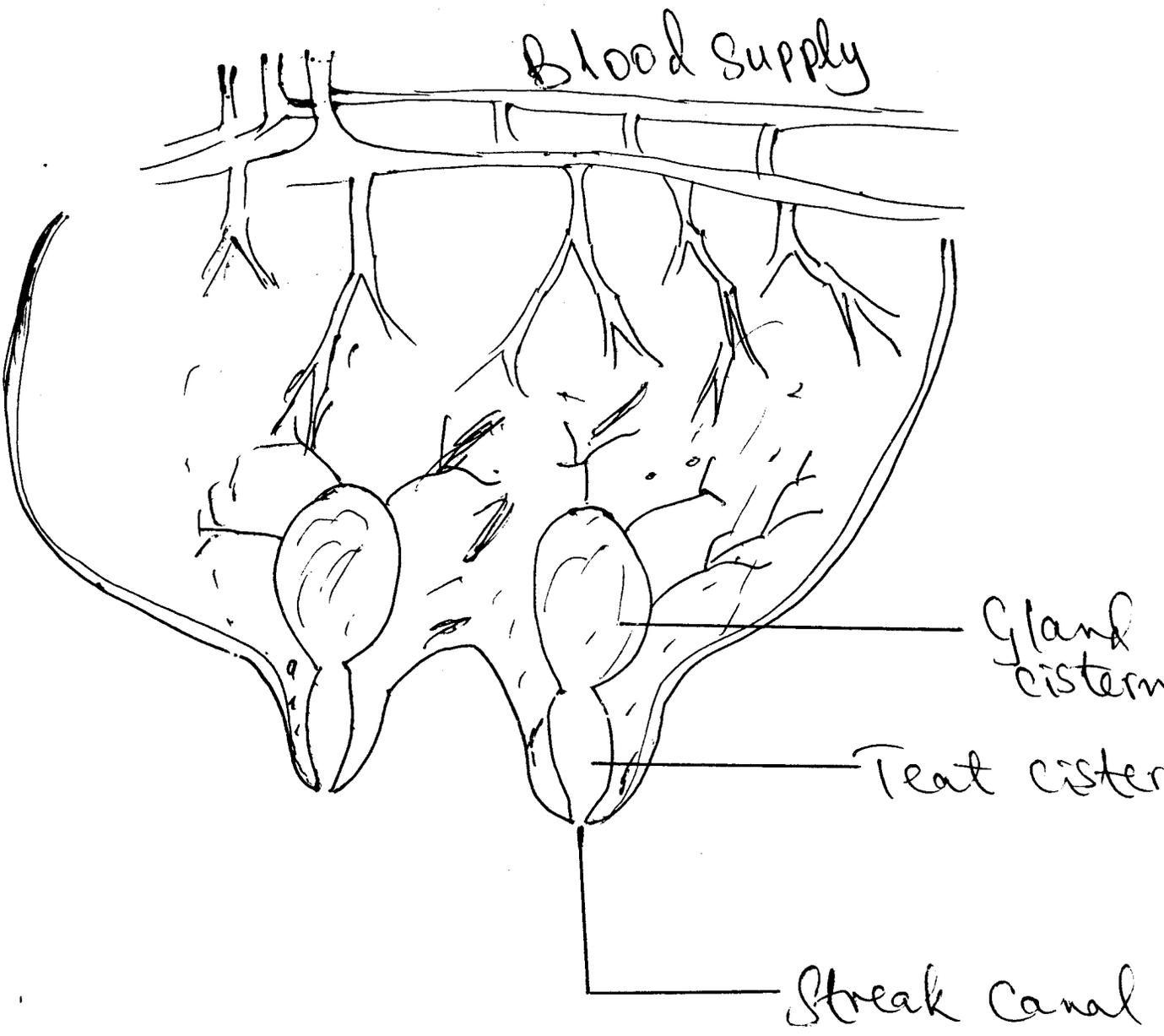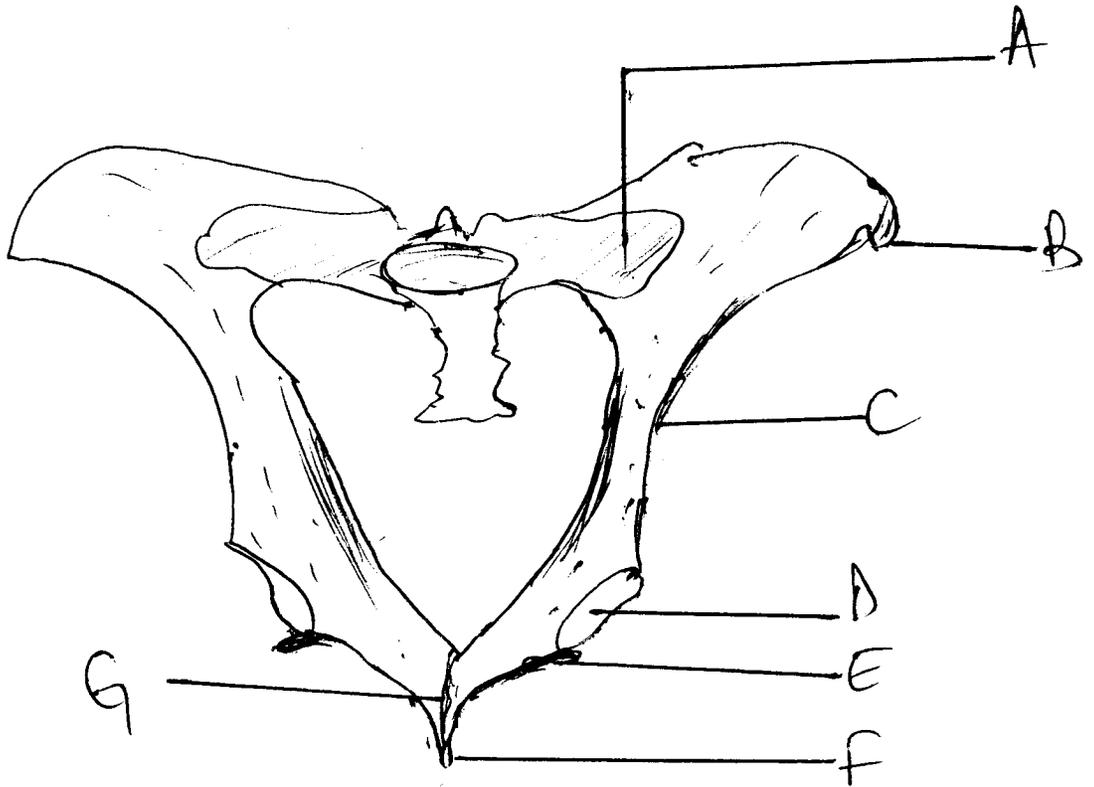
E

F

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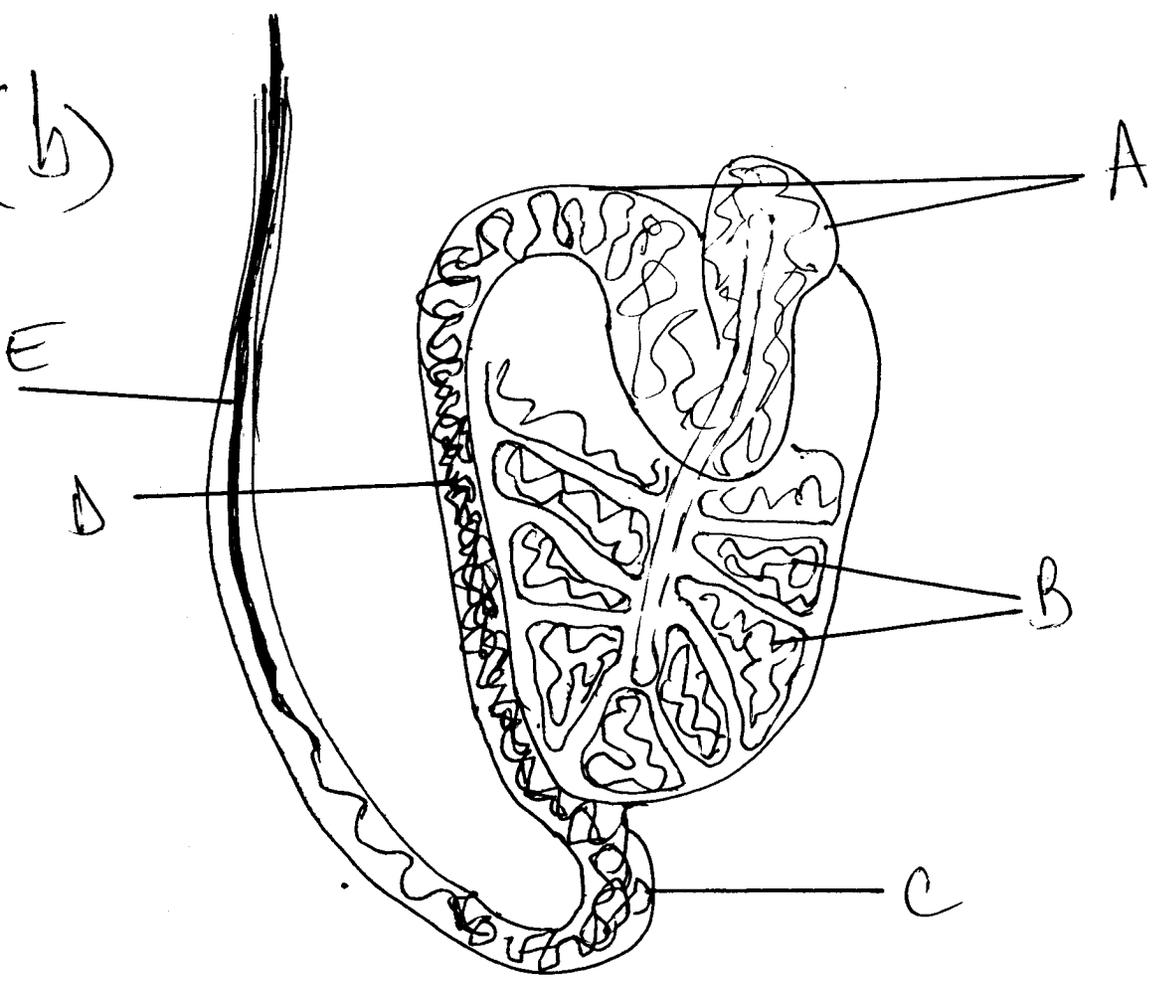
THE UNIVERSITY OF ZAMBIA
DEPARTMENT OF ANIMAL SCIENCE

Anatomy of Farm Animals
(AGA 211)

FIRST SEMESTER 2001 SUPPLEMENTARY EXAMINATIONS

Instructions : Answer <u>ALL</u> Questions
Time Allowed: THREE HOURS

Q1.   **(25 Marks)**

(a)   Make a sketch of a goat's Central Nervous System (CNS) and label the following:

(i)   Cerebrum
(ii)   Cerebellum
(iii)   Thalamus
(iv)   Hypothalamus
(v)   Pons
(vi)   Medulla oblongata

(b)   Write short notes on each of the parts labeled.

Q2.   **(30 Marks)**

(a)   Draw and label (in detail) the cow's reproductive system. Write the functions of each part of the system.

(b)   Compare the uterus of the cow with that of the sow.

Q3.   **(20 Marks)**

With regard to the cow's mammary gland, write short notes on the following:

(i)   Parenchyma tissue
(ii)   Myoepithelial cells

(iii)   Epithelial cells

(iv)   Stroma

(v)   External Pudendal artery

Q4.   (25 Marks)

(a)   Draw and fully label the "Compound Stomach" of a young ruminant and compare with that of an adult ruminant.

(b)   What are the functions of each compartment?

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END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS - MAY, 2000

AGA 222

PHYSIOLOGY OF FARM ANIMALS

INSTRUCTIONS:

Answer any five (5) questions only. Each section should be answered in a separate answer book. All questions carry equal marks.

SECTION A

1. Briefly discuss any three (3) of the following situations:

(a) Fluid partitioning in the animal's body

(b) Kidney regulation of sodium (Na+)

(c) Metabolic and respiratory acidosis and how they are compensated in the animal's body

(d) Nervous control of blood flow

(e) Heart beat

2. All body activities are controlled by the nervous system through the nerve impulse.

(a) What is a nerve impulse?

(b) How is it initiated?

(c) What factors determine speed and direction of the impulse?

(d) Describe the types of synapses found in the nervous system.

3. The borehole pump at Lungu Livestock farm breaks down and it takes three (3) days to repair i
Sheep on the farm have thus been deprived of water for three days but have had access to unlimite
feed. Discuss the effects of this water deprivation on body functions in relation to:

(a) Feed consumption levels

(b) Volume of urine excreted

(c) Na+ and K+ concentrations in plasma and urine

(d) Plasma volume

SECTION B

4. For an animal to grow, reproduce and perform other functions, it requires soluble nutrients from feed through digestion. Mastication or chewing represents the first phase of digestion and it is the mechanical breakdown of food in the mouth accompanied by mixing with saliva.

(a) List the functions of saliva.

(b) Briefly discuss how a ruminant animal obtains soluble nutrients from grasses. Include such topics as rumination, microbial digestion of carbohydrates, proteins and lipids.

(c) Should the feed of a pig (a monogastric) be of similar quality to that of a cow (a ruminant)? Discuss.

5. Efficient reproduction in farm animals leads to a profitable animal production enterprise. Reproductive activities culminating into production of a new individual are many in a female animal and they begin at puberty when heat is first observed.

(a) What signs should a farmer look out for to know that the gilt (pig) is on heat?

(b) How long is the gilt gestation period?

(c) What are estrogens, and what are the functions of estrogens in reproductive activities?

(d) What is psuedo pregnancy?

(e) For what purposes can a farmer use knowledge of the oestrous cycle?

6. Heat flow to and from the animal's body is restricted by thermal insulation.

(a) Describe the internal and external insulation found in animals.

(b) What is thermal homeokinesis or homeothermy?

(c) Describe how domestic animals attempt to lose body heat in a hot environment, and conserve heat in a cold environment.

(d) Should a domestic animal's body temperature be the same as that of its surroundings? Discuss.

THE UNIVERSITY OF ZAMBIA

UNIVERSITY FIRST SEMESTER EXAMINATIONS – JANUARY 2001

AGA 311
PRINCIPLES OF ANIMAL NUTRITION

TIME: 3HOURS

INSTRUCTIONS: READ THE QUESTIONS CAREFULLY AND ANSWER AS REQUIRED. NOTE THAT THERE ARE COMPONENTS AND CHOICES WITHIN MOST QUESTIONS.

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1.   Chose **any two** of the following:
   a)   Briefly **discuss** why vitamin A supplementation is more important in the non-ruminant than the ruminant animal. **List the functions** of vitamin A and the **consequences** of deficiency.
   b)   **Compare and contrast** the functions of the B-vitamin complex to that of the trace elements. What factors influence the metabolic effects of trace elements?
   c)   Chose a water-soluble vitamin and discuss its **functions**, under **what** conditions does vitamin become deficient and **how** is deficiency manifested in the animal?

                                                          (10 points)

2.   With the help of flow charts illustrate **any three** of the following:

   a) The absorption of lipids and how they are stored in the animal body.
   b) The importance of amino acids from dietary protein sources and those in the body.
   c) Carbohydrate digestion and absorption.
   d) Carbohydrate metabolism in the exercising muscle.

                                                           (15 points)

3. Answer **any three** of the following
     a)   With the help of a flow chart, **name** the major products of ruminant fermentation **how** they are absorbed and utilized.
     b) **Compare and contrast** digestion in the ruminant to that of the psuedo-ruminants (non-ruminant herbivore).
     c) Discuss the importance of non-protein nitrogen (NPN) metabolism to the ruminant animal and sources and their feeding levels.

d) Discuss the factors that affect nitrogen balance in non-ruminant animals

(15 points)

4. Piglets were fed a new test protein for seven (7) days to acclimatizing and another 5 days of data collection. Another group was fed a standard casein protein diet for the same period. Feed intake, fecal, urine, and weight changes were recorded. The data recorded was as follows:

Data	Measurement
Average daily Test feed intake	300g
Average daily Standard casein feed intake	250g
Percent crude protein in both diets	15%
Average daily weight gain on test diet	30g
Average daily weight gain on Standard diet	20g
Nitrogen excreted daily in urine on test protein	3.2g
Nitrogen excreted/day in feces on test diet	2.5g
Endogenous urine nitrogen on test diet/day	2.1
Metabolic fecal nitrogen on test diet/day	1.3g

Calculate the following:
a) The protein efficiency ratio (PER)
b) The net protein value (NPV)
c) The biological value (BV)
d) The net protein utilization (NPU) of the test protein.
e) Briefly **give one advantage and one disadvantage** of each method if any.

(20 points)

5. Briefly **discuss or define three** the following:

a) With the help of a flow chart illustrate the partition of gross energy in the animal
b) The basic principle in the use of respiratory calorimeters
c) The starch equivalent method for determining net energy gained.
d) What are the short term and long term theories on food intake regulation?
e) List the factors affecting food intake regulation in the ruminant animal and discuss two of them.

(20 points)

6. An experiment was conducted on a steer using the nitrogen and carbon balance to determine the amount of energy retained as fat and protein. The following data was collected:

	Carbon (g)	Nitroge (g)	Energy (kcal)
Feed intake	800	50	9000
Excreted in feces	300	15	4000
Excreted in urine	80	25	450
Excreted as methane	20	-	300
Excreted as Carbon-dioxide	300	-	-
Balance	100	10	?

Calculate the following:

a) The metabolisable energy (ME)
b) Protein stored
c) Energy stored as protein
d) Fat stored
e) Energy stored as fat
f) Total heat produced on using the metabolisable energy
g) What are the factors that influence net energy utilization (NEg) in the animal?

Assume the following values:

Carbon in body protein=51.2%
Carbon in body fat=74.6%
Caloric value of stored protein=5.3kcal
Caloric value of stored fat =9.3kcal

Please show your calculations beside each line.

(20 points)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

FIRST SEMESTER SUPPLEMENTARY EXAMINATIONS
MARCH 2001

AGA 311
PRINCIPLES OF ANIMAL NUTRITION

TIME: 3HOURS

INSTRUCTIONS: READ THE QUESTIONS CAREFULLY AND ANSWER AS
                        REQUIRED. NOTE THAT THERE ARE COMPONENTS
                        AND CHOICES WITHIN MOST QUESTIONS.

----

1.   Answer **any three** of the following:

    a) **Compare and contrast** digestion in the ruminant to that of the non-ruminants.
    b) Discuss the importance of non-protein nitrogen (NPN) metabolism to the ruminant animal and sources and their feeding levels.
    c) Briefly discuss protein digestion in the non-ruminant herbivore.
    d) Discuss the factors that affect nitrogen balance in non-ruminant animals
                                     (15 points)

2.   Chose and answer **any two** of the following:
    a)   Briefly **discuss** why vitamin A supplementation is more important in the non-ruminant than the ruminant animal. **List the functions** of vitamin A and the **consequences** of deficiency.
    b)   **Compare and contrast** the functions of the B-vitamin complex to that of the trace elements. What factors influence the metabolic effects of trace elements?
    c)   Chose a water-soluble vitamin and discuss its **functions**, under <u>what</u> conditions does vitamin become deficient and <u>how</u> is deficiency manifested in the animal?

3.   With the help of flow charts illustrate three of the following:

    e) The absorption of lipids and how they are stored in the animal body.
    b) The importance of amino acids from dietary protein sources to body protein.
    c) The importance of glucose in carbohydrate metabolism.
    d) The effects of vitamin D on calcium metabolism.
                                       (15 points)

4. Piglets were fed a new test protein for seven (7) days to acclimatizing and another 5 days of data collection. Another group was fed a standard casein protein diet for the same period. Feed intake, fecal, urine, and weight changes were recorded. The data recorded was as follows:

Data	Measurement
Average daily Test feed intake	300g
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Percent crude protein in both diets	15%
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Nitrogen excreted/day in feces on test diet	2.5g
Endogenous urine nitrogen on test diet/day	2.1
Metabolic fecal nitrogen on test diet/day	1.3g

Calculate the following:
a) The protein efficiency ratio (PER)
b) The net protein value (NPV)
c) The biological Value (BV)
d) The net protein utilization (NPU) of the test protein.
e) **Briefly give one advantage and one disadvantage of each method if any.**
(20 points)

5. Briefly discuss or define **three** the following:

a) With the help of a flow chart illustrate the partition of gross energy in the animal
b) The basic principle in the use of respiratory calorimeters
c) The starch equivalent method for determining net energy gained.
d) Carbohydrate metabolism in the exercising muscle.
(10 points)

6. a) What are the short term and long term theories on food intake regulation?
   b) List the factors affecting food intake regulation in the ruminant animal and discuss two of them.
(10 points)

7. An experiment was conducted on a steer using the nitrogen and carbon balance to determine the amount of energy retained as fat and protein. The following data was collected:

	Carbon (g)	Nitroge (g)	Energy (kcal)
Feed intake	800	50	9000
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Excreted in urine	80	25	450
Excreted as methane	20	-	300
Excreted as Carbon-dioxide	300	-	-
Balance	100	10	?

Calculate the following:

a)   The metabolisable energy (ME)
b)   Protein stored
c)   Energy stored as protein
d)   Fat stored
e)   Energy stored as fat
f)   Total heat produced on using the metabolisable energy
g)   What are the factors that influence net energy utilization (NEg) in the animal?

Assume the following values:

Carbon in body protein=51.2%
Carbon in body fat=74.6%
Caloric value of stored protein=5.3kcal
Caloric value of stored fat =9.3kcal

Please show your calculations beside each line.

(20 points)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

SECOND SEMESTER EXAMINATION – MAY, 2OOO
AGA 332 – APPLIED ANIMAL NUTRITION

TIME : THREE HOURS
INSTRUCTIONS: ATTEMPT ALL QUESTIONS

1. Discuss the following livestock feeds:
    a) legumes   b) silage   c) sorghum
    d) cassava   e) cotton seed meal   (25 marks)

2. Discuss use of non-protein nitrogen in livestock feeding   (25 marks)

3. For the requirements 3200kcal/kg ME, 23% crude protein, 1.2% lysine, 0.50% methionine, 1% calcium and 0.75% phosphorus, formulate a ration using ingredients listed below.

Ingredient	ME (kcal/kg)	CP%	Lysine%	Methionine%	Calcium%	phosphorus%
Maize meal	3330	8.6	0.24	0.20	0.20	0.28
Full-fat soya	3880	37.5	2.40	0.50	0.15	0.50
Soyabean meal	2490	45.0	3.00	0.65	0.25	0.60
Tallow	7000	-	-	-	-	-
Limestone	-	-	-	-	38	-
Dicalcium Phosphate	-	-	-	-	22	18
Methionine	-	-	-	98	-	-
Lysine	-	-	89	-	-	-
Salt	-	-	-	-	-	-
Vitamin premix*	-	-	-	-	-	-
Mineral premix*	-	-	-	-	-	-

*inclusion rate is 1%   (25 marks)

4. Formulate a dairy concentrate for a 400kg cow producing 20kg of 3.5% fat milk per day.
Nutrient requirements table

Body weight(kg)	Protein(kg)	TDN(kg)	Calcium(kg)	Phosphorus(kg)	Carotene(mg)
Maintenance					
350	0.47	2.80	0.01	0.01	40
400	0.52	3.10	0.01	0.01	42
450	0.59	3.40	0.01	0.01	48

Milk production (per kilogram of milk)

% fat					
2.5	0.07	0.25	-	-	-
3.0	0.80	0.28	-	-	-
3.5	0.80	0.31	-	-	-

Ingredients	Protein%	TDN%	Calcium%	Phosphorus%	Carotene(mg/kg)
Maize bran	9.0	85	0.02	0.28	20
Cotton seed meal	35	92	0.03	0.30	-
Limestone	-	-	38	-	-
Dicalcium pho.	-	-	22	18	-
Salt	-	-	-	-	-

(25 marks)

AGA 332 - APPLIED ANIMAL NUTRITION

TIME: THREE HOURS
ANSWER: ALL QUESTIONS. THE FOUR QUESTIONS CARRY EQUAL MARKS

1.   Discuss how the feeding value of i) soyabean meal and ii) grass hay can be influenced by processing.

2.   Identify the danger associated with feeding urea to cattle and explain how the danger can be avoided.

3.   For maize meal (8% CP), sorghum meal (9% CP) and sunflower meal (38% CP), calculate the proportions of each in the following mixtures:

i)   a 22% CP mixture of the three.

ii) a 15% CP mixture of the three containing 6% sorghum.

iii) a 30% CP mixture of the three containing equal proportions of maize meal and sorghum meal.

iv) a 25% CP mixture of the three containing 0.5% salt and 1% premix.

v)   50kg of a mixture of the three containing 20% CP.

4.   Formulate a 7kg supplement for a 300kg heifer which grazes 2kg of pasture daily containing 6% CP. The heifer requires 0.65 kg CP daily. You have sorghum (9% CP) and sunflower (40% CP) as supplement ingredients.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

SECOND SEMESTER DEFERRED EXAMINATION – JULY, 2000
AGA 332 – APPLIED ANIMAL NUTRITION

TIME: THREE HOURS
INSTRUCTIONS: ATTEMPT ALL QUESTIONS
_____

1. Describe how poor handling of hay during curing and storage can affect its feeding value.   (25 marks).

2. Write short notes on anti-nutritional factors associated with the following feed ingredients:
   a) sorghum   b) soybean   c) cassava   (25 marks).

3. Briefly discuss the following:
   a) single-cell protein in livestock feeding   b) feed additives in livestock feeds   (25 marks).

4. For the requirements 3000kcal/kg ME, 21% CP, 1.00% lysine, 0.48% methionine, 1.00% calcium and 0.70% phosphorus, formulate a ration using ingredients listed below:

Ingredient	ME(kcal/kg)	CP%	Lysine%	Methionine%	Calcium%	Phosphorus%
Maize meal	3330	8.0	0.24	0.20	0.20	0.28
Soybean meal	2490	45.0	3.00	0.65	0.25	0.60
Tallow	7000	-	-	-	-	-
Limestone	-	-	-	-	38	-
Dicalcium Phosphate	-	-	-	-	22	18
Methionine	-	-	-	98	-	-
Lysine	-	-	89	-	-	-
Salt	-	-	-	-	-	-
Vitamin premix*	-	-	-	-	-	-
Mineral premix*	-	-	-	-	-	-

*inclusion rate for vitamin and mineral premixes is 1% of diet for each.   (25 marks)

INSTRUCTIONS: ANSWER ALL QUESTIONS
TIME ALLOWED: THREE HOURS

1. Under the local poultry improvement programme, a researcher at Msekera Research Station in Chipata conducted the following experiments:

Experiment 1
Selected cockerels of local chickens showing two recessive characteristics clean shanks *(f)* and dwarf body size *(dw)* were mated to hens of the indigenous types which were breeding true for these characteristics. The female offspring of the first cross were then mated to their male parents. The results of the second cross were as follows:

Characteristics	Numbers
Clean shanks, dwarf body size	72
Clean shanks, big body size	80
Feathered shanks, dwarf body size	76
Feathered shanks, big body size	84

Experiment 2
Cockerels showing two recessive characteristics creeper legs *(cr)* and dwarf body sizes *(dw)* were mated to hens of the indigenous types, which were breeding, true for normal leg length and big body sizes. The female offspring of this first cross in the second experiment were also mated to male their parents and the following results were obtained:

Characteristics	Number
Creeper leg length, dwarf body size	128
Creeper legs length, big body size	21
Normal leg length, dwarf body size	17
Normal leg length, big body size	136

QUESTIONS
a) Using suitable genetic cross diagrams (and the symbols given) explain fully the differences in the results obtained in experiment 1and 2 in relation to Mendel's second Law of Inheritance (the Law of Independent Assortment).
b) What deductions can be made about the positions of the clean shanks, dwarf body size and creeper leg alleles on the chromosomes of the local chickens?
c) Draw the chromosome map indicating the relative positions of the clean shank, dwarf body size and the creeper leg alleles.   (20 marks)

2. a) What is meant by heritability estimates? Of what use are they to an animal breeder? (6 marks)

b) What is a progeny test? Why is it more practical to progeny test sires than dams? (6 marks)

c) What is meant by selection index? How does it differ from tandem selection? (8 marks)

3. a) In beef cattle, yearling weight is 50 percent heritable. A bull weighing 400kg at 365 days was selected for breeding from a Boran herd at Chisamba Ranch where the average weight of all yearlings was 350kg. Ten heifers weighing 360kg were also selected for breeding. What would be the expected genetic progress in the offspring of the bulls? The heifers? For both bulls and heifers? What would be the expected genetic progress in the offspring of this bull and the ten heifers? (10 marks)

b) What are the genetic effects of inbreeding? (5 marks)

d) Back fat thickness at 90kg weight in an entire pig crop at Inkaate Meat products farm in Lusaka West is 37mm. Boars measuring 25mm and gilts measuring 33mm in backfat thickness are retained is 45 percent heritable, what would be the expected backfat thickness in progeny of these parents? (5 marks)

4. a) The Christian Children's Fund is interested in starting a community based Rabbit Project in Kafue. Since the supply of purebred rabbits in Zambia is rather limited, they decided to purchase fine looking Chinchilla bucks from Botswana for breeding with the locally found New Zealand white does. But the project manager suspects that these bucks may not be homozygous at the locus C. How would you advise him to arrange for his uncertainty to be eliminated. If he mates one of these bucks with a pure breeding Himalayan doe and obtains a litter of 6 leverets, all Chinchilla, how sure would he be that this buck is homozygous for the Chinchilla gene?

(10 marks)

b) If the frequency of the red and white gene in Friesians is 1 in every 10000. How many of the individuals should be black and white? Roan? (5 marks)

c) Define genetics and explain its role in modern Agriculture? (5marks)

5. a) Explain what you understand by coefficient of inbreeding and coefficient of relationship.
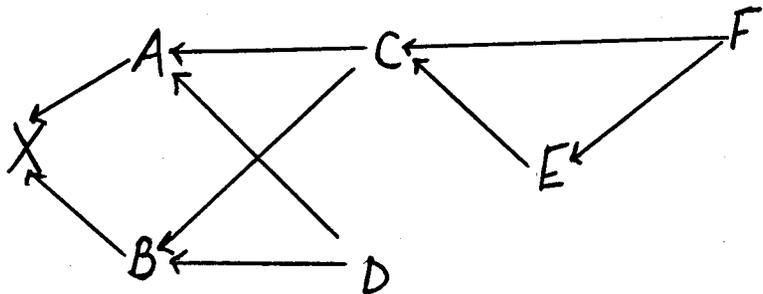
(8 marks)

b) Compute the inbreeding coefficients for individuals X and Y in the pedigrees below.
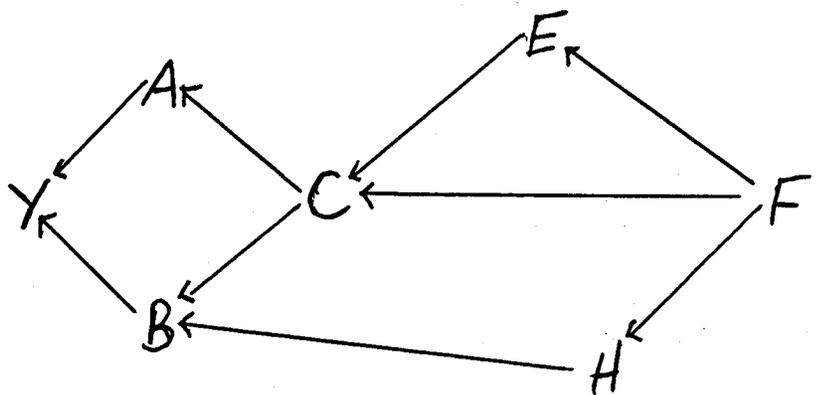
(6 marks)

c) Compute the coefficient of relationship for individuals X and Y in the pedigrees below.

(6 marks)

1.

2.

THE UNIVERSITY OF ZAMBIA

END OF FIRST SEMESTER EXAMINATIONS - JANUARY, 2001

COURSE AGA 531 - TOPICS IN ANIMAL NUTRITION

TIME ALLOWED: - THREE HOURS ONLY.

INSTRUCTIONS TO CANDIDATES: -

a)   *Answer Question 1, and any three (3) others.*

Q. 1   As a self-employed stock-feed consultant in Lusaka, formulate a broiler ration for the first phase feeding in the three-phase feeding programme for an emergent commercial farmer who wishes to compound stock-feeds on his farm with the use of the locally available feed ingredients. The broiler ration should contain 2,800 Kcal/kg ME, 22% DCP, 1% lysine, 0.6% Methionine, 3.5% Calcium. 0.85% Phosphorus, 1% Broiler (Vitamin and Mineral) Premix and 0.5% Salt.

The following feed ingredients are available: -

INGREDIENT	COMPOSITION					
	ME(Kcal/kg)	CP%	LYSINE%	METHIONINE%	Ca%	P%
Maize Meal	3350	8.8	0.24	0.20	0.02	0.28
Soyabean Cake	2230	44.0	2.93	0.63	0.29	0.65
Tallow	8000	-	-	-	-	-
Dicalcium Phosphate	-	-	-	-	26.0	18.0
Limestone Flour	-	-	-	-	38.0	-

(40 Marks)

Q. 2   There are chemical and biological methods of protein evaluation for poultry and pigs but researchers do rely on biological methods that are based on the response of experimental animals.

a)   Calculate the True Biological Value of an animal protein supplement from the data given below: -

i)   Dry matter consumed daily = 6.00 grams;

ii)   Percent nitrogen in the feed, on dry matter basis = 1.043;

iii) Daily urinary output = 10 ml containing 3.28 mg total nitrogen per ml and 2.2 mg endogenous nitrogen; and

iv)   Daily faecal output = 5 g dry matter containing 4.18 mg/g total N and 2.14 mg/g metabolic faecal nitrogen.

1

b) Discuss the use of any other biological methods of protein evaluation.

(20 Marks)

Q. 3 a) What level of milk production would you expect from a 550 kg friesian cow zero-grazed on Elephant (Napier) Grass containing 9.8 MJ/kg DM and 200 g/kg DM? Assume that there is no live-weight change and that the milk contains 5.8% butterfat and 9.8% solids-not-fat

    i) If the cow above was in early lactation and was losing weight at the rate of 0.5 kg/day, what would be her expected milk yield?

    ii) If the above cow was in her late lactation and was actually gaining weight at the rate of 0.5 kg/day, what would be her expected milk yield?

b) A beef steer on dry season grazing will lose weight unless supplemented. From the information below calculate the quantity of concentrate mixture consisting of 40% Corn and Cob Meal, 20% Maize Bran, 20% Cottonseed cake and 20% Sunflower Cake that is needed to maintain its body weight.

The following information may be used to answer the question: -

    i) The weight of the steer is 380 kg;
    ii) Dry matter intake is 1.5%of body weight per day; and
    iii) The composition of the available feed-stuffs is: -

	DM%	ME (MJ/kg DM)
Dry season grazing	90	5.8
Corn and Cob Meal	96	11.0
Maize Bran	92	10.0
Sunflower Cake	93	12.0
Cottonseed Cake	95	11.5

(20 Marks)

Q. 4 The digestibility of forages affects the dry matter intake (DMI) of such forages in ruminants but it is the DMI that determines animal productivity.

a) Describe the methods that can be used in the laboratory to estimate the digestibility of forages.

b) Describe the methods of increasing digestibility of forages that can be used by farmers.

(20 Marks)

Q. 5   Write notes on the following: -

a)   The Peter van Soest method of determining the nutritive value of forages.
b)   The critical aspects of mono-gastric nutrition.
c)   Discuss the causes, pre-disposing factors and management factors can be put in place to prevent the occurrence of acetonaemia in diary cattle.
d)   Draw a flow chart showing the partition of feed energy in ruminant animals.

(20 Marks)

The following may be used to answer any questions:

i. $Mm = 8.3 + 0.091\ W$

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

iii. $Eg = \dfrac{MEP \times 0.0435\ M/D}{1.05}$

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

v. $LWG = \dfrac{Eg}{6.28 + 0.3\ Eg + 0.0188\ W}$

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

vii. $Ml = \dfrac{EVl \times 1.05}{0.62}$

viii. $Kl = \dfrac{0.0435\ M/D}{1.05}$ or $0.0414\ M/D$

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE

ANIMAL HEALTH AGA 542

END OF SEMESTER EXAMINATIONS (MAY 2000)

INSTRUCTIONS: ANSWER ALL FIVE QUESTIONS. THEY ALL CARRY
EQUAL MARKS.

TIME ALLOWED: 3 HOURS

Q1. (a)   Name two economically important protozoa diseases of cattle in Zambia.

   (b)   Discuss the epidemiology and control measures for **ONE** of the named
diseases.

Q2.   Discuss Helminthosis in cattle under the following headings.

   (i)   2 aetiologic agents
   (ii)   economic effects
   (iii)   control measures.

Q3. (a)   Name two ecto–parasites of importance in pigs.
   (b)   Discuss the epidemiology and clinical manifestation of ecto–parasitic
infestation in pigs.

Q4. (a)   Name three economically important poultry diseases in Zambia.
   (b)   Discuss the prevention and control measures for **ONE** of the named
diseases.

   (i)   aetiology
   (ii)   transmission
   (iii)   clinical signs
   (iv)   control

Q5.   Discuss either Anthrax or Contagious Bovine Pleuropheumonia under the
following headings.

AGA 552

ANIMAL PRODUCTS AND BY-PRODUCTS

TIME ALLOWED: 3 HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS. THEY CARRY EQUAL MARKS.

Q1. Three groups of pigs were subjected to a Halothane test as follows:

GROUP			
	A	B	C
Number	50	50	50
Positive cases	2	9	37

(a) Assuming pigs from the three groups are transported on a train from Choma to Lusaka for slaughter, describe what would likely happen with respect to meat quality.

(b) Do you think all Halothane positive cases will yield PSE meat? Why?

(c) Describe in detail the biochemical process of PSE.

(d) What advice would you give to the farmer regarding group C pigs?

Q2. Choose one of the following topics and describe in detail its relevance and application in meat production.

(i) Use of beta agonists as a means of altering body composition in livestock species.

(ii) Proportion of fibre types (red, white, intermediate) in muscle.

(iii) Effect of connective tissues on meat quality.

Q3. Meat drying (for preservation) is a complex process involving several steps starting from the slaughter of an animal itself. Describe the various steps up to the final product, giving reasons why each step is important.

Q4. It takes approximately 24 hours before muscle becomes meat. Discuss the changes occurring during the conversion of muscle to meat in a beef carcass.

THE UNIVERSITY OF ZAMBIA
FIRST SEMESTER EXAMINATIONS JANUARY 2001
COURSE AGA 561 AQUACULTURE GENETICS & HEALTH

TIME ALLOWED : 3 HOURS
INSTRUCTIONS TO CANDIDATES : ANSWER ALL QUESTIONS

1.   Discuss factors that may influence a fish breeder to produce fish seed under hatchery conditions and give details of management of broodstock, eggs, larvae and fingerlings that would enhance a successful seed production programme in a hatchery.

2.   Describe in detail the role of ecological factors in spawning fish.

3.   Give details of disease prevention, control and treatment measures among fish.

4.   Describe the symptoms, life cycle and treatment/control for the following:

      (a)   One fish disease in subphylum Ciliophora.
      (b)   One fungal disease of fish.

5.   Write notes on the following:

      (a)   Copepoda parasites
      (b)   Genotypic selection
      (c)   Environmental toxicosis
      (d)   Gas embolism
      (e)   Objectives of species selection programmes in Aquaculture.

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS – MAY 2000
APPLIED ANIMAL BREEDING (AGA 562)

Time: 3 hours

INSTRUCTIONS: ANSWER ANY FIVE (5) QUESTIONS

1.A. Explain or define the following allelic relationships and cite examples of each in farm livestock.
   i)   Lack of dominance
   ii)   Multiple allelic series

1.B. Explain the meaning of each of the following terms:

   i)   sex linked traits
   ii)   sex influenced heredity
   iii)   chromosomal aberration
   iv)   crossing over
   v)   hybrid

1.C Explain the effect you believe that the practice of inbreeding has on the frequency of recessive lethal genes, the incidence of genetic abnormalities, and the likeness between herds within a purebred breed.

2.A. The average adjusted weaning weight (AWW) in a cattle herd is 210 kg and s = 22kg. It is assumed that many loci are involved with the genetic variation of this trait. The effects of two loci are:

$$BB = Bb = 2; \qquad CC = Cc = 5$$

$$bb = cc = 3$$

$$B- + C- = +1$$

$$B-cc \text{ or } bbC- = -4$$

Indicate the phenotypic effects of the following genotypes:

BbCc   BBcc

bbCC   bbCc

bbcc

2.B. Cow production records (Average weaning weight of calves) for one year are given. The herd average = 420 kg. The cows were divided into two groups (those above average and those below). The mean for the above average group was 459 kg and that for below average group was 379 kg. Assuming repeatability for this trait to be 0.5, how much (kg of calf) do you expect these two groups to differ (difference in group averages) the next year?

3.A. A purebred producer is interested in selecting for the recessive gene for red, starting with a crossbred base of 100 cattle. The initial gene frequencies are $f_b = q = 0.75$ and $(1 - q) = 0.25$. In subsequent generations, only the Black individuals will be culled, so s = 1.0. What is the value of $(1 - q)$ after two generations of selection?

3.B. At approximately what value of q is   q the highest when selecting for a recessive gene? Explain.

4.A. i)   Define coefficient of inbreeding

ii)   Define coefficient of relationship

4.B.
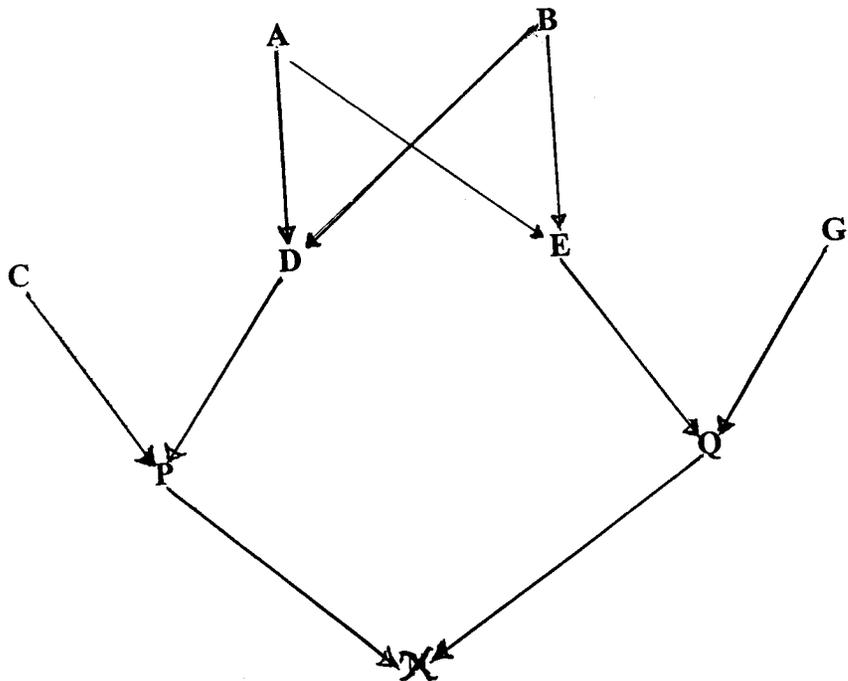
i)   Calculate F_x

ii)   Calculate R_{PQ}

iii)   What is the relationship between the inbreeding coefficient of the offspring and the coefficient of relationship between sire and dam when the related individuals are the sire and dam?

5.   Briefly describe the terminal cross breeding system, outlining its advantages and disadvantages.

6.A.   Outline the information needed to formulate a breeding program.

B.   Describe the family selection method. What are its advantages and disadvantages?

AGC 211:   **Fundamentals of Crop Science**
Time Allowed: 3 Hours

Instructions
1.   **Answer all questions**
2.   **Marks for each question as indicated**

Q1.   Systematic botany is an important aspect of plant classification to scientists world over.

    a.   Illustrate the practical importance of systematic botany   **(2)**

    b.   **The family grameneae is probably one of the most successful** **(2)** **families amongst the flowering plants**. Do you support or dispute this statement? Give two reasons to support your answer.

    c.   The family malvaceae includes crops of economic importance to Zambia.

        i.   Give the common and botanical names of an important **(2)** crop in Zambia belonging to this family

        ii.   In which agricultural region of Zambia is this crop **(4)** important? Give one reason to support your answer

    d.   To which families do the crops paw-paw, onion, mango, guava **(5)** and avocado belong?

    e.   Give the botanical names of the crops in Q1 (d) above?   **(5)**

Q2.   Discuss in detail the factors influencing photosynthesis.   **(20)**

Q3.   a.   Describe the strategies used by farmers to conserve and efficiently **(8)** utilize the water resource to achieve optimum plant growth and yield under limited water conditions.

    b.   Nitrogen is one of the most limiting factors affecting the rate of plant growth and the level of yield. Briefly discuss nitrogen under the following themes:

        i.   functions of nitrogen   **(4)**

        ii.   deficiency symptoms of nitrogen   **(4)**

        iii.   factors affecting the uptake of nitrogen   **(4)**

Q4.   Discuss in detail the different tillage techniques. Briefly outline the **(20)** advantages and disadvantages for each one of them?

Q5. a. Briefly describe the indicators of physiological maturity in various **(6)** crops

b. Give a full account of the importance of crop rotation **(8)**

c. Explain the factors that guide the planning of a good crop rotation **(6)**

End of Examination

Good Luck

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

1   Alfred Chandeya, a retired mining engineer, has settled on a cleared 100 ha plot that was part of the former Zambia Consolidated Copper Mines (ZCCM), Nchanga Farms Ltd. Prior to his retirement, he together with 20 other miners attended two ZCCM sponsored agricultural training courses of three weeks duration each at Kalulushi Farmers Training Institute and Palabana Dairy Training Institute. As a result of this training, Alfred has decided to utilize 80 ha of his farm for dairying while devoting 20 ha to arable and horticultural crop production. On dairying, he has further consulted with district weather and pasture experts who have informed him that the area receives 1650 mm of rain per anum; pasture grows at 3.2 kg ha^{-1} yr^{-1} mm^{-1} of rainfall; rotational as opposed to continuous grazing at 2 ha per livestock unit (LU) is recommended while pasture aught to be utilized at 30%.

Thus, Alfred is geared to start with a 20 cow herd with the possibility of increasing this number to 50 within the next five years. The pasture expert also advised Mr. Chandeya to grow 10 ha of maize and forage sorghum for silage while supposing that he could also obtain a 2 t dry matter (DM) in May by grazing the ratoon sorghum. The expected total DM yield of maize and sorghum silage is 12 t/ha.

Two days ago Alfred came across your consulting firm in town and has now come to your office seeking a 'second' opinion on his dairying plans in general and literature on silage in particular. What is your advice to Mr. Chandeya taking into consideration the information that has already been given. Note that ILU= 450 kg animal. (50 marks).

2   Write brief notes on four of the following (20 marks)
        i)   addition of forage legumes in an existing grass pasture
        ii)   Joint and multiple use of rangelands
        iii)   The effects of repeated defoliation on the productivity of lucerne pasture.
        iv)   Aestivation of papilionoideae and mimosoideae
        v)   Factors that influence seed yield of pasture legumes

3   The Environmental Council of Zambia (ECZ) has identified a grassland in your area that   has been severely degraded. The council under the World Bank funded environmental support programme (ESP) has asked you to re-evaluate the area and make practical recommendations on how this scenario could be redressed and there after utilized on a sustainable basis. Outline your assessments and recommendations (30 marks).

End of Examination

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCES

FINAL EXAMINATIONS - MAY 2000
AGC 332 PLANT PATHOLOGY

TIME: THREE HOURS
ANSWER: <u>QUESTION FOUR (4)</u> AND ANY OTHER THREE QUESTIONS
INSTRUCTIONS: READ THE QUESTIONS CAREFULLY

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1. a) List 10 plant disease symptoms giving disease examples and their respective pathogens.

   b) Write short notes on the following:-
   i) Horizontal resistance
   ii) Gene-for-gene concept
   iii) Plant Quarantine.

   c) What is plant pathology?

   25 marks

2. Imagine you are a plant pathologist. Explain in detail the chain of events that occur in a disease cycle and discuss the control measures for each event to a group of small scale farmers attending a course at a farmer training centre on crop protection.

   25 marks

3. a) List the crop factors, pathogen factors, and environmental factors responsible for an epidemic and explain how each factor affects the spread of a disease in a potato field infected by late blight.

   b) How can you differentiate a diseased plant from a healthy plant?

   25 marks

4. How would you go about diagonizing an unknown disease in a plant pathology lab after you receive a sample from a farmer? Explain in detail the kind of information you would need to carry out your findings in a systematic manner.

   25 marks

5. a) Explain in detail how plants defend themselves by using pre-existing defense structures.

   b) Write short notes on the following:-
   i) Control measures that exclude the pathogen from the host
   ii) Plant disease triangle.

   25 marks

6.   What do you understand by the following terms?
      a) Histological defense structures
      b) Cellular defense structures
      c) Cytoplasmic defense reactions
      d) Necrotic defense structures
      e) Disease escape.

                                                            25 marks

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END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

1998/99 SECOND SEMESTER FINAL EXAMINATION

AGC 342/411: FIELD CROP PRODUCTION.

Time: 3 Hours.

Instructions: Answer question 1 and any other four questions. All questions carry equal marks.

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1. Discuss conservation tillage and its role in crop production. (20 marks)

2. Write short notes on any four of the following:
   a. Advantages of ratoon crop in sugarcane.
   b. Shading in coffee plantations
   c. Pruning and plucking in tea shrubs.
   d. Uses of sugarcane.
   e. Characteristics of two species of coffee.

   (20 marks)

3. Explain the management strategies you would adopt in order to minimize the effects of high temperature and low soil moisture on crop production. (20 marks)

4. Explain the 6 types of vegetable gardens. (20 marks)

5. Write essays on any two of the following:
   a. Intercropping.
   b. The CAM pathway of photosynthesis.
   c. Thermal time and its relevance in crop production.

   (20 marks)

6 a. Explain the common defects, diseases and pests of potatoes and also their control.
   b. Name any 3 vegetable crops belonging to family *Solanaceae* and explain their fertilizer requirements and yield.

   (20 marks)

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCES

UNIVERSITY SEMESTER II EXAMINATIONS - MAY 2000

AGC 422 - HORTICULTURAL SCIENCE I

TIME: THREE (3) HOURS
INSTRUCTIONS: Answer all Questions.

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1. You have been appointed as a District Horticultural officer. Farmers in your district would like to grow the following:-

   a) Pine (from seed)   5 marks
   b) Peach (from seed)   5 marks
   c) Carrot (for seed production).   10 marks

   What special treatments would these require?

2. a) You have been approached by a farmer who would like to use Integrated Pest Management (IPM). Explain to the farmer what IPM is giving examples where necessary.

            10 marks

   b) Indicate the crop attacked, symptoms and control measures that would be undertake for the following:-

   i) Nematodes
   ii) Red spider mite
   iii) Blight.

            15 marks

3. A small-scale farmer would like to grow 8 hectares of onions for the first time.

   a) Prepare production recommendations.
            8 marks

   b) Advise on the diseases and pests she is likely to face in the field, symptoms and their control.
            12 marks

   c) What would be the ideal stage of harvesting the crop and what yields would the farmer expect to get?
            3 marks

4. A retired teacher would like to use fertilizers to grow her vegetable crops. What fertilizers would you recommend and why?

16 marks

5. Discuss the horticultural industry in Zambia as well as in the Southern Africa Development Community. Your discussion should include constraints, potential, etc.

16 marks

END OF EXAM

THE UNIVERSITY OF ZAMBIA
FIRST SEMESTER EXAMS - JANUARY 2001

AGC 431. AGRICULTURAL ENTOMOLOGY

TIME: 2 1/2 HOURS. ANSWER ALL QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS

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1. What is metamorphosis? Discuss in detail complete metamorphosis.

2. Outline the functions of an exoskeleton and discuss the consequences of possessing such a structure in insects.

3. Outline the causes of insect outbreaks and discuss mechanical control as a means of reducing insect populations.

4. Describe the general characteristics, structure of mouth parts and economic importance of the order THYSANOPTERA.

5. The sole radiance on insecticides for the control of insect pest has led to many problems. Discuss.

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THE UNIVERSITY OF ZAMBIA

DEFERRED /SUPPLEMENTARY EXAMINATIONS MARCH 2001

AGC 431. AGRICULTURAL ENTOMOLOGY

TIME: 2½ HOURS: ANSWER ALL QUESTIONS.

ALL QUESTIONS CARRY EQUAL MARKS

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1.   What is cultural control? Discuss the use of tillage as a means of implementing cultural control.

2.   Discuss the complications associated with insect identification and outline ways in which one may identify an insect.

3.   Describe the general characters and economic importance of the order ISOPTERA.

4.   What is metamorphosis? How is it controlled in insects?

5.   Define integrated control and outline the principal features of pest management.

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

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER EXAMS - MAY 2000

AGC 431:   AGRICULTURAL ENTOMOLOGY

TIME: 2½HOURS   ANSWER ALL QUESTIONS.   ALL QUESTIONS CARRY EQUAL MARKS

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1.   Discuss the variations in the life history of insects.

2.   Compare and contrast the distinguishing characters of the order HEMIPTERA and HOMOPTERA.

3.   The sole reliance on insecticides for the control of insect pest has led to many problems. Discuss.

4.   What is legislative control? Discuss in detail the functions of a plant quarantine division.

5.   Define integrated control and outline the principal features of pest management.

******************************** END ************************************

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER EXAMS - MAY 2000

AGC 431:   AGRICULTURAL ENTOMOLOGY

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** END **

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER EXAMS - MAY 2000

AGC 431:   AGRICULTURAL ENTOMOLOGY

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************************************** END **************************************

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER EXAMS - MAY 2000

AGC 431:   AGRICULTURAL ENTOMOLOGY

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********************************* END *************************************

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER EXAMS - MAY 2000

AGC 431:   AGRICULTURAL ENTOMOLOGY

TIME: 2½HOURS   ANSWER ALL QUESTIONS.   ALL QUESTIONS CARRY
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*********************************** END ***

UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS, MAY, 2000

AGC 442   PLANT BREEDING

INSTRUCTIONS: Answer **question #1** and any **other three questions**. Points for each question are indicated in the brackets.

TIME: 3 hours

Q. 1 (a).   One of the achievements in the use of wide crossing and polyploidy in plant breeding has been the creation of new species, therefore genotypes and varieties of crops. In the genus Brassica several species have been created from others. Given the following species show how each is related to the other(s): *B. campestris, B. juncea, B. napus, B. oleracea, B. carinata and B. nigra.* (15 points)

(b).   For each of the species give the common name and the number of chromosomes for the diploid state (2n), also explain how the wide crossing could have led to the resultant species (25 points).

Q. 2   You are contracted as a plant breeder/consultant by pioneer Hybrid Company in their cereal improvement programme. You are to demonstrate, in practical terms, the advantages of using the Modified Ear-to-Row method of breeding over the Ear-to-Row method. Outline in details the plan(s) you would implement for the purpose (20 points)

Q. 3 (a)   Describe in details the wheat improvement programme in Zambia. Give the general goal and the specific objectives, outlining the components and activities of the programme (10 points).

Q. 3 (b)   What do you understand by Field Plot Technique in plant breeding? (10 points).

Q. 4   Write short notes on the following (2.5 points each):

(a) Classes of flowers
(b) Types of variability
(c) Uses of polyploids
(d) Male sterility
(e) Mechanisms that enforce crossing
(f) Introduction as a method of breeding
(g) Types of *In vitro* growth and processes involved
(h) Formation of population for germplasm purposes

Q. 5   Define incompatibility. Differentiate heteromorphic type of incompatibility from the homomorphic type in plants (20 points).

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

FINAL EXAMINATIONS - FIRST SEMESTER, 2000/2001 ACADEMIC YEAR

TIME: THREE HOURS

ANSWER: Question 1 and any other 4 questions

COURSE: AGC 511

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1. It has been observed that yields of crops have or are reaching levels where no more increases can be expected, even when best management practices are applied. Discuss this observation, giving reasons and potential avenues for further increases in yields (20).

2. Discuss crop productivity under the following:-

    (a) Effect of leaf angle (5)
    (b) Leaf area (5)
    (c) K- Value (5)
    (d) Net assimilation rate (5)

3. Discuss how plant growth regulators may affect the yield performance. Provide examples and explanations for your answer (20).

4. Plant population can be a form of stress with respect to crop performance and subsequently yield. Explain how the stress manifests itself (10).

5   Write short notes on the following:-

    (a) Control of assimilates translocation and distribution in plants (7).
    (b) Accumulation of soluble carbohydrates (5).
    (c) Conversion of N_2 from the atmosphere to NH_3 and its importance (8).

6. (a) Define the F/G ratio and discuss its significance in terms of sink-source relationships (10).

    (b) Discuss weed competition as a stress factor in crop fields (10).

-------------------------------------- **END** ---

UNIVERSITY OF ZAMBIA

DEFERED/SUPPLEMENTARY EXAMINATIONS

AGC521 Plant breeding II   **March 2001**

INSTRUCTIONS
Answer any four questions. All questions carry equal marks. Time allowed = 3 hours

1. Write short notes on:
   a. How base analogues cause mutations   [5 points]
   b. Conservation of germplasm   [5 points]
   c. Advantages of marker-assisted selection over phenotypic selection [5 points]
   d. Disease triangle   [5 points]
   e. Interspesfic hybridisation   [5 points]

2. Distinguish triple test cross from the North Carolina Design II   [25 points]

3. (a) What is the Hardy-Weinberg equilibrium?   [10 points]
   (b) Why would selection against heterozygotes be a difficult task? [15 points]

4. Calculate estimates of heritability from the data given below obtained for protein content in soybean varieties   [25 points]

Source of variation	Df	SS
Replication	2	145.78
Treatment	24	65.24
Error	48	23.85
Total	74	234.87

5. When and why would one use induced mutation breeding in crop improvement? Explain how this method could be used to improve disease resistance in field beans.

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

UNIVERSITY SEMESTER II DEFERRED EXAMINATIONS – OCTOBER, 1998

AGC 552 – HORTICULTURE SCIENCE II

TIME: THREE (3) HOURS   CLOSED BOOK

INSTRUCTIONS: Answer Question 1 and any 4 others.

Q1.   The ability for plants to flower is determined by various processes. Name these processes giving examples and controlling parameters where necessary for each process.

[28 marks]

Q2.   a.   As a farm manager, you have been directed to grow the following:-

        i.   Pineapple
        ii.   Orchid
        iii.   Mint
        iv.   Daffodil, and
        v.   Begonia.

        How would you propagate them?

[10 marks]

        b.   Corms and rhizomes are used in propagation. Describe these terms, outlining their application, with relevant examples in vegetative propagation.

[8 marks]

Q3.   Certain plants can only be propagated by allowing adventitious roots to form on a stem while it is still attached to the parent plant.

        i.   Give the name to this process and describe it.
        ii.   What factors affect this process, and
        iii.   State the applications of this process giving relevant examples where possible.

[18 marks]

Q4   a.   Prepare notes on grafting for a farmer who wishes to grow citrus. Your Notes should include an outline of the main principles.

[9 marks]

b.   A farmer has bought a farm on which fruit trees were neglected. What options does the farmer have to rejuvenate the orchard and produce quality fruits.

[5 marks]

c.   A farmer growing tomatoes intends to maximize her returns on the good yield. What must she do?

[4 marks]

Q5.   Horticultural crops can be produced profitably for the export market. Discuss this statement in detail outlining all the factors that should be considered when growing for the export market.

[18 marks]

Q6.   As a district Horticultural Officer, you have been approached by a farmer who wants to set up a nursery infrastructure for production of ornamental plants. If most of the plants can be propagated by the cuttage method only, what would be your advice be and what considerations would the farmer have to take into account for the success of the enterprize?

[18 marks]

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF CROP SCIENCES

UNIVERSITY SEMESTER II EXAMINATIONS - MAY 2000

AGC 572 - POST HARVEST TECHNOLOGY

TIME: THREE (3) HOURS

INSTRUCTIONS: Answer all Questions.
Use a different answer sheet for each section.

SECTION A

1. A citrus packinghouse, the first one of its kind in Zambia, has just been set up in the heart of Lusaka. On the same premises, there are some storage structures.

    a) You have been employed as a Supervisor in the sorting section of the packinghouse. What measures would you put in place to ensure the smooth running of this operation?

        12 marks

    b) Describe the four(4) most important diseases that are likely to occur in storage and how would they be controlled?

        18 marks

2. You are about to harvest your rose crop for export to the Dutch Auctions and for sale on the local market. How would you ensure good marketable yields?

    17.5 marks

3. You have been approached by a vegetable grower who has only been taught about boosting crop production but does not know how to maximize her profits. What would your advice be?

    17.5 marks

SECTION B

4. Using specific horticultural crops as examples, outline the adequacy and inadequacy of post harvest systems in Zambia. State the conditions during harvest, transport, processing and distribution with reference to nutritional value.

    17.5 marks

5. Discuss maturity and maturity standards and their relationship to quality.

    17.5 marks

END OF EXAM

THE UNIVERSITY OF ZAMBIA
DEPARTMENT OF AGRICULTURAL ECONOMICS

UNIVERSITY EXAMINATIONS – FIRST SEMESTER EXAMINATIONS
AGE 211: FUNDAMENTALS OF MICRO-ECONOMMICS

INSTRUCTIONS: **Answer all questions in Section A and any four from Section B**
Time: 3 hours

SECTION A: Answer all questions in this question paper and hand it in together with the answer booklet.

1. The market demand curve is derived from individual demand curves by vertical summation T/F.

2. The fact that a supply curve slopes upward to the right is consistent with the fact that the more of a good made, the more it costs to produce. T/F.

3. A curve has greater than unit elasticity at point x when quantity demanded changes by a higher percentage than does price. T/F.

4. When the price level is constant, a rise in the money price of a good means that it has become more expensive in terms of other goods. T/F

5. The slope of the budget line indicates the opportunity cost of one commodity in terms of other commodities. T/F.

6. The hypothesis of diminishing marginal utility implies that I gain six times as much satisfaction from my second car as I do from my third television. T/F.

7. Average variable cost is always equal to or below average total cost. T/F.

8. Profit maximization is a sufficient condition for cost minimization. T/F

9. If the AC curve is rising, the MC curve must be above it. T/F.

10. A Supply curve which is a horizontal straight line would mean:

    a)   whatever the price, only one amount is ever produced.
    b)   below a certain price, none is ever produced.
    c)   above a certain price, none is ever produced.
    d)   above a certain price, so much is produced that the graph is not big enough to show it.

11. A right ward shift in a supply curve indicates that:

    a)   a higher price is necessary to call forth any given quantity supplied than before the shift occurred.

b) less will be supplied at each possible market price
c) the willingness of producers to supply the commodity has diminished
d) more will be supplied at each possible market price
e) none of the above answers is correct

12. A supply curve that is a vertical line has an elasticity that is:

a) zero
b) more than zero
c) one
d) greater than one
e) negative

13. A rightward shift in the supply curve of some product will reduce the equilibrium price to a greater degree.

a) the more elastic is the demand curve.
b) the less elastic is the curve.
c) the more the elasticity of demand diverges from unity in either direction
d) the closer the elasticity of demand is to unit.

14. An indifference curve includes:

a) constant quantities of one good with varying quantities of another.
b) the prices and quantities of two goods that can be purchased for a given sum of money.
c) all combinations of two goods that will give the same level of satisfaction to the household.
d) Combinations of goods whose marginal utilities are equal.

15. Households may attain consumption of a higher indifference curve by all but which o f the following?

a) an increase in money income
b) a reduction in absolute prices
c) a proportionate increase in money income and in absolute prices
d) a change in relative prices caused by a reduction in one price.

16. If the price of substitutes falls; How will the market demand curve of a normal good shift?

17. Define an inferior good ....

18. Define production function ....

....

....

19. If a firm uses three factors of production, what is the minimum number which must be fixed in a short run? ....

20. What is an isoquant? ....

....

....

SECTION B: Answer any four questions

1. The following table shows the marginal utility measured in terms of utils that Peter would get by purchasing various amounts of products A, B, C, and D,. Assume the prices of A, B, C, and D are K12, K2, K3 and K9, respectively and that Peter has a money income of K200.

Unity of Commodity	A	B	C	D
1	36	15	24	72
2	30	12	15	54
3	24	8	12	45
4	18	7	9	36
5	13	5	6	27
6	7	4	5	18
7	4	3.5	2	15
8	2	3	1	12

a) What quantities of A, B, C, and D, will Peter purchase to maximize satisfaction?
b) Supposing the income changes to K400. What quantities of A, B, C, and D will Peter purchase to maximize satisfaction?
c) If the prices of A, B, C, and D changed to K20, K2, K3, and K6 respectively. What is the new equilibrium level of Peter?
d) Why is the ordinal measure of satisfaction more preferred over the cardinal measure?
e) Explain why indifference curves do not intersect each other. (20 marks)

2. A given product can be produced with the following combinations of resources:

Combination	Resources	
	X_1	X_2
1	9.0	2
2	6.1	3
3	5.0	4
4	4.4	5
5	4.1	6
6	4.0	7
7	4.1	8
8	4.1	9

Also given the prices of X_1 and X_2: Px1 = K2, Px2 = K3, output of 105

a) Complete the minimum cost combination of X_1 and X_2.
b) Draw and Isoquant and Isocostline on a graph and show the least cost combination point.
c) What is the least cost criterion?
d) Define the marginal rate of technical substitution.
e) What is the difference between an isocostline and budget line?

3. Consider this demand schedule:

P	Q
K4.00	7.0
3.75	8.0
3.50	9.0
3.25	9.5

Imagine that this is the demand for bus transportation in an area. The prices are the average fares in kwacha per passenger kilometer; the quantities are millions of passenger kilometers per month. Suppose the practical problem is one of lowering fares.

a) What is the coefficient of elasticity of demand at K3.75?
b) At K3.50?
c) Should the firm lower prices given the elasticity coefficients you have calculated? Why? Or why not?
d) What formula have you used? And why?

4. Assume the following unit cost data for a purely competitive producer:

Total Product	AFC	AVC	ATC	MC
0	K	K	K	K
1	60	45	105	45
2	30	43	73	40
3	20	40	60	35
4	15	38	53	30
5	12	37	49	35
6	10	38	48	40
7	9	39	47	45
8	8	41	48	55
9	7	43	50	65
10	6	47	53	75

a) At a product price of K32, will this firm produce in the short-run? Why or why not? If it does produce, what will be the profit maximizing or loss minimizing out put? Explain.

b) Explain: "That segment of a competitive firm's marginal-cost curve that lies above its average-variable-cost curve constitutes the short-run supply curve for a firm." Illustrate graphically.

c) In long-run equilibrium, P = AC = MC. Of what significance for allocation of resources is the equality of P and AC?

d) What is the difference in the level of output between pure competition and Monopoly?

5. Discuss the major barriers to entry under pure monopoly. Explain how each barrier can foster monopoly? Which barriers if any do you think give rise to monopoly that is socially justifiable?

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER EXAMINATION – MAY 2000
AGE 222
MACRO ECONOMICS

INTRUCTIONS
1. TIME: MAXIMUM OF THREE (3) HOURS
2. ANSWER QUESTIONS 1, 2 AND ANY OTHER THREE QUESTIONS

1. You are provided with the following data from the national income section of the Ministry of Finance. The data is in 1998 current prices.

ITEM	K' in billions
Expenditure by Local Government	20
Gross fixed capital formation	15
Consumption	50
Value of manufactured stocks	7
Exports	25
Imports	20
Depreciation	7
Subsidies	6
Employee bonuses	3
Taxes	15
Property income from abroad	6

Compute the:

a) GDP at factor cost
b) GNP at market cost
c) Net National Product
d) Disposable income
e) Real GNP for 1998 if the C.P.I based on 1990 prices was 110 %.
(20 marks)

2. An open economy with a floating exchange rate system has the following information:

C = 200 + 0.8(1-t)Y;   I = 600 – 50i;   t = 20%
G = 400;   X=200   Q=0.04Y
Pl=300;   Pf=720
e=250;   i = 6%

where C = consumption; I = investment spending; t = tax rate; Y is national income or output; i = Interest rate; G = government spending; X = exports; Q = imports; Pl = local price level; Pf = foreign price level; e = nominal exchange rate (Kwacha per US Dollar);

(a)	Compute the real exchange rate.
(b)	Compute the open economy multiplier.
(c)	Compute the equilibrium income.
(d)	Compute the net trade balance.
(e)	If exports fall by 20, compute the new income equilibrium and how much the trade balance change.
(f)	If interest rate increases to 8% (instead of exports falling by 20 in (e), how does the trade balance change? Explain why it changes that way.
(20 marks)

3. (a) The table below shows the hypothetical unit costs for producing cloth and bread in Zimbabwe and Zambia.

Country	Production Costs (in Kwacha) per unit	
	Cloth	Bread
Zambia	15 000	10 000
Zimbabwe	10 000	5 000

   (i) State the principle of absolute advantage (2 marks)
   (ii) State the law of comparative advantage. (3 marks).
   (iii) On the basis of the law of comparative advantage, indicate the commodities which each of the countries should export/import. (5 marks)

   (b) (i) Define fiscal policy (2 marks)
   (ii) How are budget deficits financed in discretionary fiscal policy? Explain the effects of each financing mechanism. (8 marks)

4.   Write short notes on the following:

a)   "leakages and injections" in a 4 sector economy
b)   Transfer payments
c)   Net Domestic Product
d)   "Crowding out" effect
e)   GDP deflator
        (20 marks)

5.   The following table shows some of Zambia's macroeconomic variables for the   period 1980-1985:

Year	CPI	Employment rate (%)
1980	202.9	21.6
1981	231.3	20.5
1982	260.2	19.5
1983	311.1	18.8
1984	373.0	18.2
1985	513.5	17.7

(a)   Compute the inflation rate for each year in the period 1981-1985.
(b)   Compute the unemployment rate for the years 1981-1985
(c)   Plot Phillip's curve for the period 1981-1985
(d)   What does Phillip's curve in (c) indicate about the major cause of inflation in the period 1981-1985?
         (20 marks)

6.   (a)   Define the quantity theory of money, and explain how money supply is related to inflation.
        (b)   How does cost push inflation occur?
        (c)   What is the role of the Bank of Zambia (the Central Bank)?
        (d)   With the aid of a diagram, show how the IS curve is derived
        (e)   With the aid of a diagram, show how the LM curve is derived
                    (20 marks)

3

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SECOND SEMESTER SUPPLEMENTARY EXAMINATIONS –
JULY 2000

AGE 222
MACRO ECONOMICS

INTRUCTIONS
1. TIME: MAXIMUM OF THREE (3) HOURS
2. ANSWER QUESTIONS 1, 2 AND ANY OTHER THREE
    QUESTIONS

1. Suppose you are provided with the following data from the national income section of the Ministry of Finance. The data is in 1999 current prices.

ITEM	K' in billions
Expenditure by Local Government	35
Gross fixed capital formation	15
Consumption	70
Value of manufactured stocks	16
Exports	20
Imports	25
Property income paid abroad	3
Depreciation	5
Subsidies	6
Employee bonuses	2
Direct taxes	10
Property income from abroad	4

Compute the:

a) GDP at factor cost
b) GNP at market cost
c) Net National Product
d) Disposable income
e) Real GNP for 1999, if the C.P.I based on 1990 prices was 210 %.

(20 marks)

2.	A closed economy has the following information:

$C = 0.8(1-t)Y$

$I = 900 - 50i$

$t = 25\%$

$G = 800$

$L = 0.2\ Y - 62.5i$

$M = 50\ 000;$

$P = 100$

Where;

C = consumption;

I = investment;

t = tax rate;

i = Interest rate;

G = government purchases;

L = real money demand

M = nominal money supply

P = price level

a)	Derive the IS equation.

b)	Derive the LM equation.

c)	Compute the equilibrium income and interest rate.

d)	What is the impact of increasing government purchases by 100%?

e)	How much does money supply have to rise in order to accommodate the fiscal policy in (d)?

(20 marks)

3.	a)	The table below shows the hypothetical unit costs for producing butter and bread in Zimbabwe and Zambia.

Country	Production Costs (in Kwacha) per unit	
	Butter	Bread
Zambia	10 000	15 000
Zimbabwe	10 000	5 000

i)	State the principle of absolute advantage (2 marks)

ii)	State the law of comparative advantage. (3 marks).

iii)	On the basis of the law of comparative advantage, indicate the commodities which each of the countries should export/import. (5 marks)

b) Supply-side economists argue that "a reduction in taxes will shift the supply curve to the right". Discuss the arguments advanced by the economists (10 marks)

4. Write short notes on the following:

a) "leakages and injections" in a 4 sector economy
b) Transfer payments
c) Net Domestic Product
d) "Crowding out" effect
e) GDP deflator

(20 marks)

5. With the aid of a diagram, explain how:

a) an expansionary monetary policy works in an open economy with a floating exchange rate.
b) the goods and assets markets interact.
c) unemployment is related to inflation.
d) Money supply affects inflation at full employment

(20 marks)

6. a) Discuss the different types of unemployment.
b) How does demand-pull inflation occur?
c) Discuss the functions of money.
d) What is the cost of high unemployment?

(20 marks)

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

SHORT ANSWERS

1. Define the following Concepts:
   * Culture
   * Institution
   * Association
   * Gender
   * Bureaucracy   (20 marks)

2. Sociology is a study whose concern is specifically social behaviour. Explain briefly.   (5 marks)

3. Distinguish clearly between Karl Marx's view of class and Max Weber's view of the same. (5mrks)

4. What is your understanding of an "open integrated type of community? (5 marks)

5. To what extent is agriculture a dominant motif in rural areas?   (5 marks)

6. Briefly explain the effect of Social Stratification upon the sharing of knowledge and flow of ideas through a society. (5 marks)

7. What is the difference between traditional and charismatic authority?   (5 marks)

8. Discuss the major characteristics of the structural functionalist perception of religion.   (5 marks)

SECTION B
ANSWER TWO QUESTIONS ONLY

1. Some kind of working group is always of value as a focal point at which external inputs and local knowledge can be brought together. How far true is this assertion. Discuss   (20 marks)

2. Social inequality is the device by which societies ensure that the most important positions are filled by the most qualified persons. Discuss (20 marks)

3. Individualism is often valued highly in urban societies. Explain what it is and with practical examples contrast with a typical rural community. (20 marks)

THE UNIVERSITY OF ZAMBIA
DEPARTMENT OF AGRICULTURAL ECONOMICS
FIRST SEMESTER EXAMINATION
AGE 411 – (INTRODUCTION TO AGRIBUSINESS MANAGEMENT)

DATE:	4th January 2000; TIME: THREE HOURS
INSTRUCTIONS:	Section A – Answer All the 3 Questions
	Section B – Answer Any 2 Questions

SECTION A

Q1. Kama Farms Limited held a performance review meeting on 1st December, 2000. At this meeting the General Manager pointed out that the Dairy Section of the farm expected to increase the daily milk-out put from the current 400 litres a day to 600 litres a day in the year 2001. He then repeatedly emphasised the importance of good MANAGEMENT and MANPOWER PLANNING as vital tools in achieving this intended objective. He also called upon the Human Resource Department to be active and contribute to the profits of the firm.

Given the above background information, answer the following questions:

a) What is Management?
b) State the functions of a manager.
c) Define Manpower planning.
d) Explain clearly how the human resource function can contribute to the profits of a firm.

Q2. The purpose of a Balance Sheet is to show the financial position of a business on a specific date. It reports this financial position by showing the business's Assets, Liabilities and Equity. The balance sheet also displays the Accounts Receivable and the Accounts Payable.

Answer the following questions:

a) Write the accounting equation to show the relationship between Equity, Assets and Liabilities.
b) Define Assets, Equity and Liabilities
c) What are Accounts Receivable and Accounts Payable?
d) In the accounting equation in (a), under which heading (i.e. Assets, Equity and Liabilities) would you allocate Accounts Receivable and Accounts Payable.

Q3. According to Kotler (1997), there are five competing concepts under which organisations can choose to conduct their marketing activities i.e. the production concept, the product concept, the selling/sales concept, the marketing concept and the societal marketing concept.

Answer the following questions:

a) Define the selling/sales concept.
b) What leads most companies to adopt the selling/sales concept?
c) Which of the above concepts would you advise a business firm to adopt? Give reasons to support your answer.
d) The choice of the best concept from among the five concepts stated by Kotler leads to total customer satisfaction. State at least five benefits that a firm gains from having highly satisfied customers.

SECTION B

Q1. The management of Kama Farms Ltd. is considering expanding its Dairy and Poultry (i.e. Layers) operations in the year 2001. The Dairy project is called project A and the Poultry project is called project B. Due to cash constraints, Kama Farms Ltd. can only invest in one of the two projects and the following is a tabulation of the capital investment proposal and the expected cash flows:

	Project A £	Project B £
Initial Capital Expenditure request estimated	700	700
Future cash flow from operations in year:		
1	200	100
2	300	200
3	500	700
4	800	800
5	200	nil
Total Estimated Cash Flow	2000	1800

NB: Assume no difference in riskness between the two projects.

Compound rate of return = 3

Answer the following questions:

a) You have been asked to advise Kama Farms Ltd. on the choice between the two projects, i.e. project A and B. And you have two methods at your disposal, i.e. the payback method and NPV method. Which of the two methods would you use? Give reasons to support your answer.
b) In which of the two projects should Kama Farms Ltd. invest? Give reasons to support your answer.

Q2. The financial information tabulated below is extracted from one of the financial statements of Kama Farms Ltd.

PROJECTS

	A	B
Debt at 10% interest	$ 900	$ 0
Equity	100	$1000
Total Assets	$1000	$1000
EBIT	120	$ 120
Less interest expense	90	0
Earnings before tax	30	120
Less tax at 40%	12	48
Earnings after tax	18	72
ROE	?	?
ROA	?	?
RONA	?	?

On the basis of the information in the table, answer the following questions:

a)   Calculate ROE, ROA and RONA for the two projects, A and B.
b)   Explain the significant difference between ROE and ROA.
c)   After calculating financial ratios, how do we then use them to decide whether a company is healthy or sick? (Discuss at least three approaches)

Q3.   The Zambian Government has established a free market economic system and has gone further to join the COMESA Free Trade Area. This has created a lot of fear amongst the members of the Zambia Association of Manufacturers and the Zambia National Union of Farmers. There is fear of stiff market competition from outside firms.

However, Michael Porter of the Harvard Business School, a specialist in industrial economics and business strategy has identified five forces that determine the intrinsic long-run profit attractiveness of a market or market segment. He also pointed out that the nature and degree of competition in an industry hinges on these five forces.

Now answer the following questions:

a)   Name the five competitive forces outlined by Michael Porter. Give your answer by showing the model of these forces.
b)   Try to explain how the members of the Zambia Association of Manufacturers and Zambia National Farmers Union can utilise Michael Porters' model of the five competitive forces in order to remain competitive in their industries despite Zambia having a free market economy and having joined the COMESA Free Trade Area.

TIME: 3 HOURS
INSTRUCTIONS: ANSWER ALL FOUR QUESTIONS

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1. Based on data from 1980 to 1995, the relationship between maize output (Y) and two inputs labor (X_1) and fertilizer (X_2), was estimated using regression analysis.

$$Y = B_0 + B_1 X_1 + B_2 X_2$$

Y = output of maize, metric tonnes
X_1 = labor input in working days
X_2 = fertilizer in metric tonnes

The following were the results at 5% level of significance.

Variable	B - Coefficients	Standard error
Constant	-5.5385	
Labor	1.4988	0.5000
Fertilizer	0.4899	0.1000
R-squared	0.88	
Adjusted R-squared	0.75	
S.E of regression	0.012	
F-statistic	28	

a) Which explanatory factors are significant in determining maize output?

b) Setup and test the relevant hypothesis for the significance of the individual coefficients and the overall model. Illustrate your answers where possible and use the rules of thumb.

c) Interpret the R-squared and Adjusted R-squared.

d) What is the economic meaning of the parameter estimates?

2. a) Briefly outline the main steps in econometrics research.

   b) Discuss the importance of Gauss - Markov theorem in econometric analysis.

   c) Briefly discuss the desirable properties which estimated parameters of economic relationship should possess.

3. Discuss multicollinearity as a problem for OLS estimation. Indicate (a) Nature of the problem .(b) How to test for the presence of the problem. (c) How can you correct for the problem when your test indicates that it exists.

4. Briefly discuss the following terms:

   a) Central limit theorem
   b) Coefficient of multiple determination
   c) Ordinary least square method
   d) t - distribution

UNIVERSITY OF ZAMBIA
DEPARTMENT OF AGRICULTURAL ECONOMICS & EXTENSION EDUCATION

AGE 452: INTERMEDIATE AGRIBUSINESS MANAGEMENT

MAY, 2000

TIME: THREE (3) HOU

Answer **ONLY FIVE (5)** questions out of six. Questions 1 and 2 are compulsory. Each question carries 2
marks

1. The table below shows sales performance of various strategic business units (SBUs) of an Agrif
   and their closest competitors in their respective market segments:

SBU	1	2	3	4	5	6	7	8	9	10
SBU Sales ('000')	20	40	20	15	5	72	30	32	22	10
Competitors' Sales ('000')	5	50	25	10	10	36	120	25	11	40
Market growth (%)	2	15	11	12	5	14	11	3	13	7

   (a) Classify each SBU according to the BCG approach, and give reasons for your decision.
   (b) What strategies do you need for each SBU for the overall performance of the Agrifirm?
   reasons for your choice.

2. The following table gives the internal environment for three Agrifirms selling citrus fruits at K
   kg in a multisegment market under pure competition:

Agrifirm	Actual Sales (kg)	Price (K/kg)	Cost Function
A	90	250	$4y^2-710y+36,000$
B	330	250	$0.5y^2-80y+3300$
C	200	250	$y^2-140y+1950$

   (a) Which of these firms enjoys cost leadership advantage at current sales?

   (b) What organizational strategy is needed for each firm in order to achieve maximum efficiency?
       reasons.

   (c) If after reorganization new entrants with average variable costs of K70 per kg came into the in
       which firms would withstand competition? Give reasons.

   (d) If input suppliers negotiate for a rise in costs for the cost leader (after reorganization and new
       entrants), how high should that firm (cost leader) tolerate costs to rise?

3. Explain how Porter's five forces affect small scale maize producers in Southern Province of Za

4. Many dairy firms produce milk and other milk products for the Lusaka market which is consid
multisegment. Discuss how these firms are using the alternative generic approaches to formin
competitive strategy when serving this market. Outline the advantages firms accrue for using t
approaches.

5. Explain the product management strategies, and how they may be used in different product ma

6. Write short notes on:
   (a)   assessing competitors' strengths and weaknesses.
   (b)   what comprises the business strategic planning process.
   (c)   what makes a buyer group weak.
   (d)   marketing strategies at introduction stage of product life cycle.

TIME: THREE (3) HOURS
ANSWER: FIVE QUESTIONS. QUESTIONS <u>ONE, TWO</u> AND <u>THREE</u> ARE
        COMPULSORY. CHOOSE ANY OTHER <u>TWO</u> QUESTIONS.
MARKS: AS GIVEN BELOW

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1. Define or explain the following concepts and briefly discuss their relevance to research in agricultural marketing.

   a) Cross elasticity of demand
   b) Marketing Margin   (25 marks)
   c) Homogeneity condition
   d) Cobweb theorem

2. The following are mechanisms for discovering farm prices:

   a) Individual negotiation
   b) Auctions
   c) Formular pricing
   d) Group bargaining
   e) Administrative pricing   (25 marks)

   i) What criteria would you use to evaluate the above pricing arrangements?
   ii) What are the disadvantages and advantages of each of the above methods?

3. Changes in the markets for and marketing of agricultural products have resulted in increased attention being given to the effects of these changes on pricing and operational efficiency:

   a) What is pricing efficiency?
   b) What is operational efficiency?
   c) Describe changes in marketing which have tended to improve pricing efficiency in Zambia since market liberalization.
   d) Describe some factors which have tended to retard the achievement of operational efficiency.

   (20 marks)

4. The concept of elasticity is one of the most useful tools in applied economics:

   a) Define elasticity.
   b) Illustrate its use in the Marketing of Agricultural products
   c) Describe problems and procedures of empirical estimation

   (15 marks)

5. What are the potential gains or impacts of uniform product grading? What are the arguments for and against maize grading in Zambia? (15 marks)

6. Briefly outline the main issues to be addressed before privatising or commencialising an agricultural marketing parastatal. (15 marks)

END OF EXAM

THE UNIVERSITY OF ZAMBIA

UNIVERSITY DEFERRED/SUPPLEMENTARY EXAMINATIONS – MARCH 2001

AGE 541

TIME: THREE (3) HOURS

INSTRUCTIONS:

(i)   ANSWER ALL QUESTIONS
(ii)   LEAVE COMPOUND/DISCOUNTING TABLES IN THE EXAMINATION HALL

Q1.   Write short notes on the following (highlight the main points and give an example where applicable).

    a)   Economic analysis   (5)
    b)   Inflation in project analysis   (5)
    c)   Length of the project period   (5)
    d)   Depreciation in project analysis   (5)

Q2.   Money Lupiya borrows ZK 15 million from a Commercial Bank to invest in a medium scale agro-processing plant. He is given a grace period of three years after which the loan is to be repaid in six equal payments of principal. The opportunity cost of Capital is 25%.

    a)   Compute the amount of debt service during and after the grace period.

    b)   Assuming inflation to be 15%, compute the declining real burden of debt service.

Q3.   J. Price Gittinger is quoted as follows:
"Projects are the cutting edge of development".

    a)   Explain what is meant by a project being the cutting edge of development. (4)

    b)   Discuss the reasons that may cause a well thought out project to fail.   (12)

    c)   Are projects and programs one and the same thing? Explain.   (4)

Q4.   Nigeria is a net importer of wheat. The government proposes to set up a project to produce wheat for domestic consumption to replace imported wheat. The fob price at the port of export - port of Galvestone, USA – is $2,700.00 per ton. Freight and insurance at Lagos, Nigeria is $720.00 per ton. This cost includes unloading at the port of import. The official exchange rate between the Naira, N, (Nigeria's currency)

and the $ is N1= $1.50. No tariffs are levied on imported wheat which is not subsidised in the local market. Landing and port charges are levied at N960.00 per ton. Local transport and marketing costs to the wholesale market is N690.00 per ton. The cost of primary marketing (i.e. assembly, cost of bags, etc) and transport from the project to the wholesale market is N870.00 and N690.00 per ton respectively. Finally, there is a storage loss of N580.00 per ton.

i)   Calculate the import parity price of wheat at the farm gate.   (12 marks)

ii)   If the premium on foreign exchange is 10% what is the import parity price in economic analysis.   (8 marks)

Q5. Given below are the costs and benefits of investing in a poultry unit.

Year	Investment Outlay	Operation & Maintenance	Cash in flows
1	6,000,000	200,000	1,700,000
2	-	200,000	1,950,000
3	-	250,000	2,225,000
4	-	250,000	2,000,000
5	-	300,000	2,000,000

a)   Compute the internal rate of return (IRR)   (10)

b)   If the opportunity cost of capital cost is 18%, would you accept this project for investment? Explain.   (6)

c)   Discuss the major differences between discounted and undiscounted measures of project worth.   (6)

TIME: THREE HOURS
ANSWER: 5 QUESTIONS (20 MARKS EACH)
MARKS: 100
DATE: 19/05/00

ANSWER FIVE QUESTIONS ONLY

1. What is meant by "Targetting"? Describe the process and explain which extension problem it helps to solve.

2. What do you understand by the following terms?

   a) Min Max Strategy
   b) Extension Communication
   c) Agricultural Extension
   d) Diffusion of innovation

3. What is an organisation? How is this distinguished from a system?

4. Extension delivery structures are said to be undemocratic. State the reasons for this?

5. Outline and briefly explain the five characteristics of innovation affecting the rate at which they diffuse and are adopted.

6. What steps would you adopt in developing an extension plan. Discuss the main factors to be considered at each stage.

7. Discuss the importance of evaluation and feedback within a cycle of training activities for any village - level training programme with which you are farmiliar.

8. Explain briefly any five major extension deficiencies described by Benor Harrison and Baxter (1984).

THE UNIVERSITY OF ZAMBIA

2ND SEMESTER EXAMINATIONS - MAY 2000

INTERMEDIATE FARM MANAGEMENT
AGE 562

TIME: 3 HOURS

INSTRUCTIONS: ANSWER <u>ALL</u> QUESTIONS

Q1. a) Personnel management requires an understanding and appreciation of basic human needs. Discuss any four of these needs. (4)

b) What are the relationship between the concepts of responsibility, authority and accountability? (12)

c) Mazoe Banda runs a large piggery farm. He wishes to employ a Piggery Manager. Write a job description for the Piggery Manager to be employed. (4)

Q2. a) Why is land such an important resource on the farm? (4)

b) Discuss the Income Approach to land appraisal. What are the strengths and weaknesses of this method. (12)

c) What advantages are there of renting compared to owning farmland? (4)

Q3. Zakaria Phiri has managed to secure a loan of $330,000=00 from the Development Bank of Zambia for the expansion of his dairy enterprise. The conditions of the loan include 15% interest rate and a 7 year repayment period. The loan is to be repaid in equal installments.

a) Compute the amount of loan repayment and develop an appropriate table to show the amount of interest and   principal for each of the loan repayment years. (8)

b) What important factors should Zakaria take into consideration in his expansion of the dairy enterprise? (8)

c) What impact would high inflation have on the decision to expand the dairy enterpise? (4)

Q4. **a)** At Masese Farm the capital structure is such that the debt to equity ration is 40:60. the Farm Manager Ms. Enelesi Tikambilane has estimated that the cash return proportion of capital is 8%, increase in market value of assets is 6%, marginal tax rate is 30% and the proportion of the non cash return that is subject to tax is 35%. Meanwhile, the interest rate on borrowed capital is 20% compute:

    i)   The after tax rate of return. (6)

    ii)   The weighted average cost of capital. (6)

b) Chitunzitunzi Jere plans to purchase a tractor. The alternatives available to him are: a brand new tractor at K100m or a used tractor at K60m. The new tractor has a useful life of 8 years while the old tractor has 5 years of useful life. The present value of the net cash inflows totals K70m and K48m for the new and used tractors respectively. Assuming the weighted average cost of capital to be 10% determine the most profitable alternative. (8)

Q5. **a)** What is the importance of credit to a farmer?(2)

b) Discuss the 3Cs of credit and relate these to the failure by small-scale farmers to secure loans from financial lending institutions. (9)

c) There are three methods of accumulating equity. Discuss these methods and comment on the extent of their appicability in Zambia today. (9)

End of Examination

UNIVERSITY OF ZAMBIA

SECOND SEMESTER EXAMINATIONS - MAY 2000
AGRICULTURAL POLICY - AGE 572

TIME: 3 Hours

INSTRUCTIONS: There are two sections to this paper; Section I and Section II.
Provide your answers to the two sections in different answer books.
Follow the instructions in each section.

SECTION I

Answer any two questions from this section:

1.   a)   Examples are numerous of situations where the price system does not result in satisfactory allocation of resources. Using examples from Zambia, discuss this statement. (10 marks)

   b)   Briefly discuss the following concepts (10 marks):
   (i)   Public goods
   (ii)   Monopolistic model
   (iii)   Perfectly competitive model
   (iv)   Equity and efficiency in welfare economics
   (v)   Impact of the Structural Adjustment Program on the agricultural sector

   (c)   Briefly discuss the conflicts and dilemmas among the various objectives of the agricultural sector in Zambia. (5 marks)

2.   (a)   Given the natural resources, the propensities to save, invest, and be efficeint will be high and the economic growth most rapid in a country possessing characteristics of secular ascetism and functional activism. Discuss the relevance of this statement in Zambia.
(10 marks)

   (b)   Mnay people argue that the government should withdraw from the agricultural sector. Discuss the appropriateness of this statement.
(5 marks).

   (c)   Most of the Donors argue that the government has no policy for the agricultural sector. Do you agree with this position. Explain the answer. (10 marks)

3. a) Many people believe that it is possible to transform the small-scale farmers to a level where they could contribute to the sectoral objectives. Analyze the constraints of small-scale farmers and then suggest ways of overcoming them. (15 marks)

    b) You have been summoned by the Parliamentary Subcommittee on agriculture to prepare a paper on the commercialization of the smallholder sector. Briefly discuss the major points you would use in preparing the paper. (10 marks)

SECTION II

Answer all questions from this section:

Q4. a) When is food security assumed to exist for a country? (3 marks)

    b) Discuss any three forms of food insecurity. (6 marks)

    c) Discuss and analyse arguments that have been advanced in support of pan-territorial food crop pricing. (6 marks)

Q5. a) How did the original concept of Sector Investment Programs (SIPs) evolve? (3 marks)

    b) What basic features characterise SIPs? (4 marks)

    c) Discuss the bottlenecks that have been experienced in the course of implementing ASIP in Zambia.   (8 marks)

Q6. a) What formal and informal rural financial services exist in Zambia? (4)

    b) Discuss the considerations that rural households apply when putting together a savings portfolio. (8 marks)

    c) How can microfinance institutions increase savings among rural households? (8 marks)

UNIVERSITY SECOND SEMESTER EXAMINATIONS - MAY 2000

AGE 582
PROJECT MONITORING AND EVALUATION

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER FOUR OF THE
FOLLOWING QUESTIONS. EACH QUESTION IS WORTH 20%.

TIME: THREE (3) HOURS

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1. You have been appointed as a Monitoring and Evaluation Coordinator in a development agency contracted by the Ministry of Agriculture to manage an agricultural project in Luapula province. As M&E Coordinator, one of your tasks is to design a project monitoring system. Describe the components of a project monitoring system that you would design. Cite appropriate examples to explain the purpose and the timing in the application of each of these components.

2. a) Monitoring and Evaluation (M&E) are of critical importance in realising the objectives of rural development projects. Define the terms "Monitoring" and "Evaluation" and comment on the distinction between monitoring and evaluation.

    b) Elaborate on the purpose of Ongoing, Mid-term, Terminal and *Ex post* evaluations.

3. a) Both Quantitative and Qualitative methods are used in collecting monitoring and evaluation information. Comment on the distinction between quantitative and qualitative methods of data collection.

    b) Citing appropriate examples, explain the conceptual and methodological issues or problems associated with defining and measuring basic demographic data, income and employment in quantitative evaluation studies.

4. a) Although the most common survey instrument for most kinds of evaluation studies is the questionnaire, a number of other tools are available. Identify four of these other tools and briefly explain what they are. You should also outline the advantages and disadvantages associated with using these tools.

    b) In addition to focus group interviews, there are other qualitative methods of data collection. Identify five of these and briefly explain what they are.

5. a) Choosing proper indicators is critical for collecting monitoring and evaluation data. Why is it important to chose appropriate indicators?

    b) Identify and explain the criteria for effective indicators.

    c) Explain why it is important to incorporate beneficiaries' assessments of projects in evaluations.

6. *Ex post* evaluations are also referred to as impact evaluations. Identify and give a rationale of the kinds of data that you would collect and analyse in an *ex post* evaluation of an agricultural development project involved with introduction and promotion of improved technologies among small-scale farmers.

7. Write brief notes explaining the following:

    a) Logical Framework Analysis
    b) Project Stakeholders
    c) Social Analysis
    d) Quasi-Experimental Designs
    e) Triangulation or Multimethod Approaches

END OF EXAMINATION

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

FIRST SEMESTER EXAMINATIONS-- JANUARY, 2001

GENERAL MICROBIOLOGY (AGF 211) - THEORY PAPER

TIME: THREE (3) HOURS
INSTRUCTIONS: ANSWER FIVE (5) QUESTIONS ONLY

1. Describe and draw Gram-positive and Gram-negative envelopes. Explain the practical relevance resulting from named differences between the two groups.

2. Write brief notes on the following major nutritional types of microorganisms:

(a) autotrophs
(b) heterotrophs
(c) chemoorganotrophic heterotrophs
(d) lithotrophs

3. Explain how the total aerobic yield in micro-organisms is 38 molecules of ATP.

4. Write brief notes on the following terms:

(a) F factors
(b) R factors, and why R factors are of health importance
(c) bacteriocins, and why bacteriocins are useful in food industry
(d) aflatoxins, which microbial species produce aflatoxins, and why aflatoxins are of health importance
(e) Phalloidin and alpha-amanitin produced by the "destroying angel" mushroom, *Amanita phalloides*

5. (a) Diagramatically illustrate six methods of asexual reproduction in fungi.

(b) Make a diagramatic representation of the life cycle of Rhizopus stolonifer

6. Describe the choice between lysogeny and lysis in phage lambda.

--END OF EXAMINATION--

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

March 2001

CHEMICAL TECHNIQUES IN FOOD ANALYSIS I (AGF 311) – SUPPLEMENTARY EXAMS

TIME: 3 HOURS

INSTRUCTIONS

- **ANSWER ANY 3 OF THE 4 QUESTIONS IN THIS PAPER**
- **NOTE THAT EACH QUESTION IS WORTH 20 MARKS**

===

QUESTION 1

(a) H_2O_2 solution is analysed by adding excess of standard $KMnO_4$ solution and back-titrating unreacted $KMnO_4$ with Fe^{2+} solution. A 0.587g sample of the H_2O_2 solution is taken, 25m 0.0125M $KMnO_4$ is added, and the back-titration requires 5.10 ml of 0.112M Fe^{2+} solution. Wh the % H_2O_2 in the sample? How else would you have determined the level of H_2O_2? (5H$_2$($2MnO_4^- + 6H^+ \rightarrow 5O_2 + 2Mn^{2+} + 8H_2O$; $5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$).

(b) Describe the titrations of chloride using Fajan and Volhard and the need to use acidic environn during titrations. Name the type of indicators used and the principles operation of these adsorp indicators.

(c) Discuss steps followed in order to obtain a good precipitate. What do you understand by the te Von Weirmann ratio and peptization in precipitation reactions?

(d) What is the need for non-aqueous titrations and give two examples of such titrations of bas well as acidic compounds.

QUESTION 2

(a) The purity of hydrazine N_2H_4 sample was determined by titration with iodine. A sample weig 1.42g was dissolved in 1L of water, a 50ml aliquot was titrated with iodine solution requ 42.21ml. The iodine solution was standardised against 0.4123g As_2O_3 primary standard which dissolved in NaOH, adjusted to pH 8 and titrated requiring 40.28ml iodine solution. What is t purity of hydrazine. What type of titration is this (iodometry or iodimetry explain)? ($N_2H_4 + 2$ $N_2 + 4H^+ + 4I^-$; $H_2AsO_3^- + I_2 + H_2O \rightarrow HAsO_4^{2-} + 2I^- + 3H^+$)

(b) Describe 2 volumetric methods used in analytical chemistry and how you would use such me to determine the levels of Ca in milk.

(c) The retention times of several compounds measured from sample injection are: air, 45 se[...]
propane, 1.5 min; pentane, 2.35 min; acetone, 2.45 min and xylene, 15.0 min. What are the relati[...]
retentions for the compounds using pentane as standard? What is the resolution between acetc[...]
and pentane if their base widths are 2 and 3 mins respectively?

(d) What is the difference in principles of operation between dialysis, osmosis and ultrafilteration[...]
analysis? Give examples of their use.

QUESTION 3

(a) A 0.200g sample containing urea $(NH_2)_2CO$ is analysed by the Kjeldahl method. Ammonia[...]
collected in 50ml of 0.05M H_2SO_4 and the excess acid titrated with 0.05M NaOH, a proced[...]
requiring 3.40ml. Calculate %urea in the sample. What indicator could have been used in [...]
titration?

(b) Calculate the pH of a buffer solution containing both 0.300M HOAC and 0.200M NaOAC. (pK[...]
4.76).

(c) What do you understand by the terms: retention time, retardation factor, theoretical plate [...]
resolution. How would you improve resolution in chromatography?

(d) Describe the methods used to establish the levels of peroxide value and iodine value in oils. Wha[...]
the significance of these oil qualities?

QUESTION 4

(a) One tenth mole of salt of a weak base is dissolved in 500ml of water. If pH is 5.50, what is the [...]
of the base?

(b) Describe ways in which the end-points of redox titrations may be detected visually. What is [...]
difference between standard potential and formal potential?

(c) What do you understand by the terms: gravimetric factor, Ostwald ripening, solubility const[...]
agglomeration and explain their uses in analysis.

(d) To recover levels of tin from foodstuffs, samples were boiled for different times in an open ve[...]
and the results are as follows:-
30 min boiling: 57, 57, 55, 56, 56, 55, 56, 55
75 min boiling: 51, 60, 48, 32, 46, 58, 56, 51
Test whether the boiling time affects the variability of the results and the mean of the recover[...]
tin.(At 95% confidence limit for F value is 3.79).

....................END OF EXAM....................

UNIVERSITY OF ZAMBIA

DEFERED/SUPPLEMENTARY EXAMINATIONS

AGG 311 Probability & statistics

~~AGC521 Plant breeding H~~   **March 2001**

INSTRUCTIONS
Answer any four questions. All questions carry equal marks. Time allowed = 3 hours

1. Test for independence of the two variables, growth habit and protein content from the following data.   [25 points]

Growth habit	Protein classes			Total
	I	II	III	
Standard	8	24	7	39
I/Standard	11	28	17	56
I/Alpha	9	31	11	51
Alpha	1	14	11	26
Total	29	97	46	172

2. Given the following results, give a comprehensive interpretation.   [25 points]

Source of variation	Df	SS	MS
Among varieties	5	847.05	169.41
Within varieties	24	282.93	11.79
Total	29	1129.98	

Variety means (oil content %)
Mpempo   28.8
Sinte   24.0
Kwale   14.6
Sunu   19.9
Ngimbu   13.3
Busuma   18.7

3. Using a paired t-test and f-test separately, test the appropriate hypothesis for the following data.   [25 points]

Sample A	Sample B
10.6	10.2
9.8	9.4
12.3	11.8
8.7	9.1
8.8	8.3

4. (a) define the following: [3 points each]
   1) Sample space
   2) A quartile
   3) Probability
   4) Treatment
   5) An experiment

   (b) Explain in detail why we need to learn statistics. What are the practical uses or applications of statistics?   [10 points]

5. Give a comprehensive explanation of how you would design an experiment to evaluate five traps for catching ticks in a grazing field.   [25 points]

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

MAY, 2000

AGS 222: FUNDAMENTALS OF SOIL SCIENCE

MARKS: 60   TIME: 3 HOURS

INSTRUCTIONS: Answer all questions and be concise. Candidtes are requested in their own interest to write legibly.

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1.   (a)   Describe how soil reaction influences plant growth. [5 marks]

      (b)   One major problem of growing plants in nutrient media (hydroponics) is controlling the high pH. Explain why this problem arises in this growth media [5 marks]

2.   A soil has an effective CEC of 4.3 cmol (+) kg $^{-1}$ and an acid saturation of 66%.

      (a)   If it is desired to grow maize, requiring an acid saturation of 25% in the top 20 cm of the soil, how much agricultural lime (CCE=100%) would you need to apply to the soil in order to make it suitable for the crop ? [5 marks]

      (b)   If lime with a neutralizing value of only 65% is used, how much of this material should you apply? [2 marks]

      (c)   Determine whether or not K fertilizer would be required for maize, given a soil test value of 0.15 cmol K kg^{-1} and assuming that 180kg K/ha to 20 cm deep is adequate for the crop? [3marks]

3. The Instability Index (II) of a soil monocropped for several years was 0.86. A similar soil was manured regularly over the same period of time and the following data were obtained:

Diameter of soil aggregates(mm)	Average Diameter(mm)	Aggregate %	
		After dry sieving	After wet sieving
8 - 5	8.0	18	10
5 - 3	6.0	42	23
3 - 2	4.0	20	37
2 - 0	5.0	20	30

(a) Calculate the II of this soil and determine whether the manuring improved soil aggregation [6 marks]

(b) Discuss soil aggregate bonding mechanisms, giving one specific example for each mechanism [8 marks]

4. Define each of these terms, giving the category (Order, Suborder, etc), and briefly describe a few profile features characteristic of each. [10 marks]

Natrustalfs
Durargids
Fragiaquepts
Cryofibrists
Vertic Calciustolls

5. Describe the mechanism through which nutrients reach plant root surfaces, specifying the conditions under which each mechanism would be the major process [8 marks]

6. Discuss the effect of soil moisture on plant growth, with specific reference to: [8marks]
    (a) water potential
    (b) imbibational and osmotic forces
    (c) plant nutrition

END OF EXAM

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

May 2000

AGS 322
SOIL PHYSICS

TIME: THREE HOURS
MARKS: 100 AND ALL Questions carry equal marks

<u>Answer all questions. Be precise. Scientific calculators are allowed</u>.

QUESTION 1

(a) Water movement in a soil takes place under influence of potential differences
    (i)   Describe the various component potentials to which moisture in a soil is subjected?
    (ii)   What is the major potential for saturated ground water flow?
    (iii)   What is the major driving potential for unsaturated soil moisture flow?

(b) (i)   When a dry soil is inundated or wetted, what zones of soil layers would you get as water infiltrates the soil?
    (ii)   Which equations would you use to determine the flow for a short and long duration infiltration?
    (iii)   Define and describe a storage coefficient of a soil profile after water has infiltrated into it
   (iv)   What are the physical factors affecting radiation distribution?

QUESTION 2

(a) (i)   What is the hydraulic conductivity for water in the soil?
    (ii)   What factors determine the value of the hydraulic conductivity?
    (iii)   Mention two methods used to determine the hydraulic conductivity in the laboratory?
    (iv)   A sample was tested in a constant head permeameter. Soil sample is 5cm high and 8 cm in diameter. Water percolates through the soil under a constant head of 45 cm for 8 minutes. The water was collected and weighed and its weight recorded as 500gms. Calculate the hydraulic conductivity? [*Given the hydraulic conductivity is equal to the product of the volume and length of sample divided by the product of the head, area and time*]

(b) (i)   The mean composition of soil air varies with what five factors?
    (ii)   Describe the two types of pores involved in soil aeration?
    (iii)   What are the two main processes involved in the replacement of soil air?

QUESTION 3

(a) Give an explanation of the moisture characteristic of a soil on the basis of its suction?
(b) What is the hysteresis phenomenon in the pF-moisture relation?
(c) From the diagram/graph/curve below;
    (i)   Determine or describe points 1,2,3,4,5, and 6
    (ii)   What is readily available soil moisture and by what aspects is it determined?

Diagram 1. The Characteristics of the pF-curve
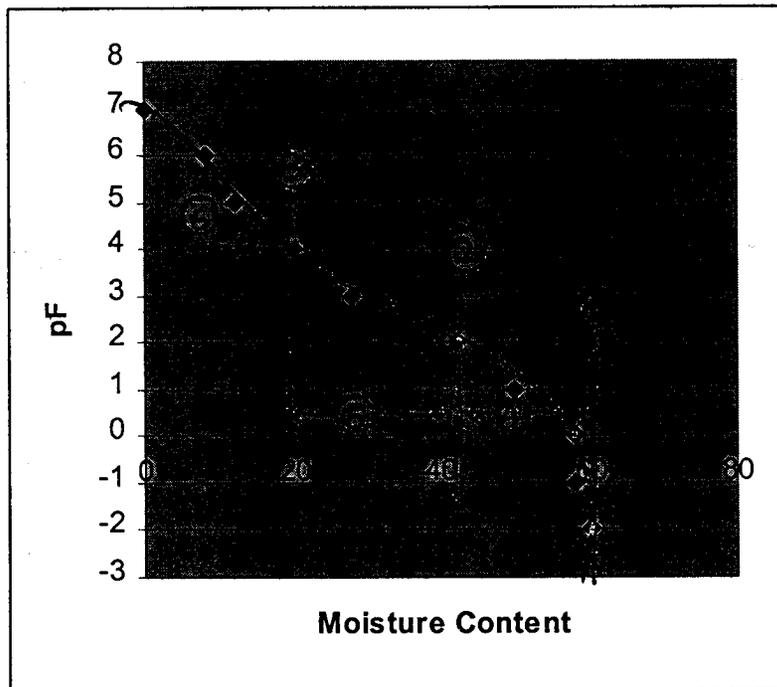
QUESTION 4

(a) From the curve below estimate the following
    (i)   Proportion of total work required for cutting through the soil at minimum and maximum speed?
    (ii)   Proportion of total work required for over-coming cohesion and shear forces at minimum and maximum speed?
    (iii)   Proportion of the total work required for the other tillage aspects at minimum and maximum speed?

(b) What is the major dynamic property of a soil involved in soil-machine interactions?
(c) What is scouring and what factors cause non-scouring of soil?

Diagram 2. Relative contribution of cutting, sliding friction and shear plus acceleration to draft of an inclined tool
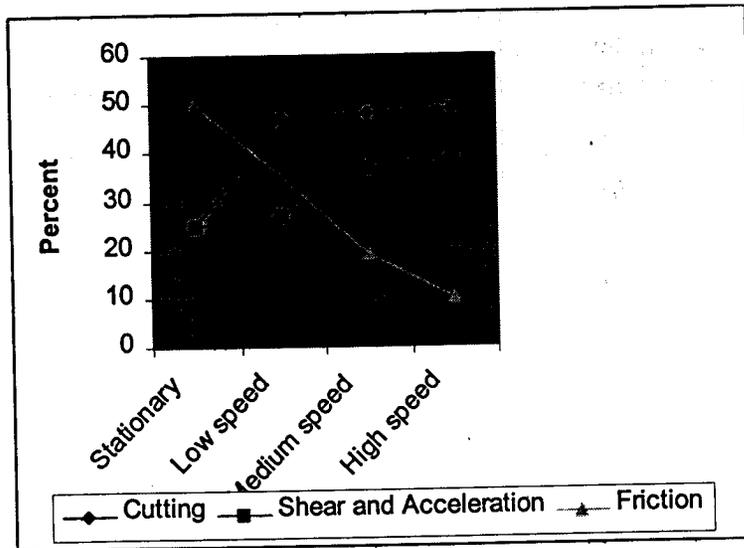
QUESTION 5

(a) What is soil consistency and what are the different forms?

(b) (i)   What is the significance of the Atterberg limits?

     (iii)   What factors affect the Atterberg limits?

(c) (i)   What is shear strength of a soil?

     (ii)   Determine the value of C and Φ for sample used in direct shear test. Observations made   at failure in the laboratory are

Normal Stress	Shear Stress
1 kg/cm^2	0.905 Kg/cm^2
1.5 kg/cm^2	1.05 kg/cm^2
2.5 kg/cm^2	1.30 kg/cm^2

(c) (i)   What are the factors affecting capillary conductivity?

     (ii)   What is the importance of capillary rise?

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

AGS 331 SOIL SURVEY TECHNIQUES

MAY 2000

ANSWER ALL QUESTIONS

TIME: **3 HOURS**   80 MARKS

1.   Discuss the applications of aerial photo interpretation in Soil Surveys.   [10 marks]

2.   A farmer in Mazabuka would like to know the soil productivity potential on his 600ha farm with the ultimate objective of developing a sustainable land use plan. Describe in detail the methodology you would apply. [10 marks]

3.   Describe the operation of a Side-Looking Airbone Radar(SLAR) and its applications. [10 marks]

4.   Discuss the basic principles of the land capability classification system. [10 marks]

5.   (a)   Discuss the concepts of salinity and alkalinity. [5 marks]

      (b)   Where in Zambia would you expect salinity and alkalinity problems and explain why and how.? [5 marks]

6.   Describe the characteristics of the following: [10 marks]

      (a)   Argillic horizon
      (b)   Spodic horizon
      (c)   Histic epipedon
      (d)   Oxic horizon
      (e)   Mollic epipedon

7.   Suggest a methodology for correlation and quality control in soil surveys. [10 marks]

8.   Discuss seven(7) major characteristics of the soil that determine productivity and value of land for irrigation. [10 marks]

END OF EXAM

THE UNIVERSITY OF ZAMBIA

UNIVERSITY FIRST SEMESTER EXAMINATIONS
JANUARY 2001

AGS 411 - SOIL FERTILITY

TIME: 3 Hours   MARKS: 60

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

1. Do you think a good understanding of soil fertility issues is of great importance in the process of solving Zambia's poverty issues? Give five reasons to support your answer.   [10]

2. (a) What is Capacity Factor   [1]
   (b) How do you calculate Capacity Factor   [1]
   (c) What does a large Capacity Factor mean in terms of soil fertility   [2]
   (d) Discuss the rate of transfer of nutrients between the solid and liquid phases in relation to Capacity Factor   [2]
   (e) Explain nutrient retention in soil fertility   [2]

3. (a) What is reversibility of cation exchange?   [1]
   (b) Give two conditions (reactions) when reversibility is not possible   [2]
   (c) What is a complementary ion effect in exchange equilibria   [2]

4. (a) Why are fertilizers applied to soils?   [2]

   (b) Why is soil pH important in nutrient availability considerations. Give examples.   [4]

   (c) What advice would you give to farmers who resort to applying Basal and Top dressing fertilizers at the same time because fertilizers have come late? Give the different points you would use in your discussion   [4]

5. (a) What are multinutrient fertilizer?   [2]

   (b) Calculate the amounts of ammonium nitrate (34% N), Single Supers (20% P_2O_5) and Potassium Chloride (60 % K_2O) needed to prepare a 6 - 14 - 5 compound fertilizer.   [6]

   (c) How much of additional materials do you need in the compound fertilizer of 5 (b) above ?   [2]

6. (a) What is the effect of burning surface organic matter on different essential nutrients? [2]

    (b) Give five reasons why organic matter is important in soil fertility considerations. [10]

7. (a) Why are there more micronutrient deficiencies today as compared to many years ago. [3]

    (b) Discuss the use of chelates in the supply of Fe and Mn to alleviate the deficiency of these micronutrients. [2]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

MAY 2000

AGS 422 SOIL MICROBIOLOGY

TIME: 3 HOURS
MARKS. 100 MARKS
ANSWER ALL QUESTIONS AND BE CONCISE

1. Describe four major ways through which atmospheric N_2 is converted to plant usable form [8 marks]

2. Describe how pathogenic microorganisms can be controlled in sewage before the sludge and water are recycled to the environment.   [10 marks]

3. (a) What is associative symbiotic N_2 fixation, and how does it differ from symbiotic N_2 fixation? [6 marks]

   (b) Discuss the limitation of symbiotic dinitrogen fixation in meeting N requirements for crop production [4 marks]

4. Define the following terms: [6 marks]
   (a) ammonification
   (b) nitrogen immobilization
   (c) diazotroph

5. (a) Nitrification can be termed a "mixed blessing". What does this mean?.
      [5 marks]

   (b) Describe practical ways in which the efficiency of nitrogen fertilizer might be improved. [5 marks]

6. Discuss the importance of organic matter in soil fertility with particular reference to organic matter fractions. [10 marks]

7. (a) The dissolution of phosphate rock [$Ca_5(PO_4)_3F$] can be enhanced and crop uptake of P increased by composting the ground rock with manure and crop residues. What is the explanation of this observation? [5 marks]

   (b) The practice of sterilizing greenhouse soil with methyl bromide often results in reduced Zn, and P uptake and stunted plant growth. Why? [2 marks]

8.	Under what conditions would versicular arbuscular mycorrhizal (VAM) symbiosis with plants be most beneficial agronomically? [10 marks]

9.	It is not uncommon to find aerobic and anaerobic conditions in different parts of the same lake at the same time, particularly in the warm summer months. Explain why this phenomenon occurs. [9 marks]

10.	(a)	Give a detailed account of the process and practicality of producing biogas for domestic use. [5 marks]

	(b)	What are the advantages of composting organic materials compared to their direct application to soils? [5 marks]

11.	(a)	Outline the detrimental effects of excess phosphates on aquatic ecology [5 marks]

	(b)	River or lake water that has been artificially warmed can be considered to have undergone "thermal pollution".
		(i)	What does this mean? [3 marks]
		(ii)	How does thermal pollution occur? [2 marks]

END OF EXAM

THE UNIVERSITY OF ZAMBIA

UNIVERSITY FIRST SEMESTER EXAMINATIONS - JANUARY 2001

AGS 431
SOIL MINERALOGY AND MICROMOPHOLOGY

TIME: 3 Hours   MARKS: 90

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

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1.   Define:

    (a)   Primary minerals

    (b)   Secondary minerals   [6]

2.   One of the major mineral classes comprises Oxides, Hydroxides and Oxyhydroxides. Discuss the different minerals and their characteristics under this group.   [10]

3.   (a)   Describe the montmorillonite group of minerals   [3]

    (b)   Discuss the characteristics of montmorillonite and how these charasteristics affect the soils in which montmorillonite is dominant   .   [7]

4.   (a)   What are the basic principles of X- ray Diffraction analysis?   [4]

    (b)   Give three different ways in which samples for XRD may be pre-treated before analysis.   [3]

    (c)   Why are samples for XRD analysis pretreated?   [2]

5.   Briefly and consicely describe how you would go about determining the mineralogical composition of the sand, silt and clay fractions of a soil if you have a polarizing microscope and an X-ray diffraction machine at your disposal.   [15]

6.   Results of the study of Soil minerals under a microscope indicate the following:

Mineral	Number of grains counted.
Quartz	250
Olivine	15
Biotite	28
Tourmaline	03
Zircon	04

1

(i)   Calculate the number of grains you require to get an estimate of Biotite grains with an allowable error of 10% at a confidence level of 90%.[5]

(ii)   What nutrients would ~~you get to~~ be supplied ~~readily from~~ the weathering, of the weatherable minerals in soil.   [5]

by ∧

Note: t - value for 90% confidence level at $\propto$ df is 1.645

7.   A clay sample containing only Kaolinite $Al_2Si_2O_5(OH)_4$ and muscovite $K\,Al_2\,(Al,Si_3)\,O_{10}(OH)_2$ is found to contain 3.27% K_2O [5]

(i)   What is the percentage of muscovite in the sample , assuming that muscovite is the source of all the potassium present in the sample?   [5]

(ii)   What % weight loss would you expect of this sample at 550° , due to the dehydroxylation of Kaolinite.   [7.5]

(ii)   List at least 4 XRD peaks would you expect to find on the diffractogram of this clay sample (Give reasons for your answer).   [7.5]

(iv)   If muscovite is weathering at a rate of 2% annually, how many kilograms of K would be released from 30 tonnes of the clay through the weathering muscovite in the first year.   [5]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

May 2000

AGS 441
### AGRICULTURAL HYDROLOGY AND HYDRAULICS

TIME: THREE HOURS
MARKS: 100 AND ALL Questions carry equal marks

<u>Answer all questions. Be precise. Scientific calculators are allowed.</u>

QUESTION 1

(a) Study the agro-hydrologic cycle of an orchard in the Gwembe Valley in Southern
Province. From the diagram (*Diagram1*);
   (i)   Estimate the amounts required at A,B,C, and D to balance the cycle
   (ii)   List the five bottlenecks in the cycle labelled 1,2,3,4 and 5
   (iii)   What management measures can be implemented to minimise disturbances at 1?

(b) How can you increase the effectiveness of rainfall from the agricultural point of view?
Mention and explain two of the measures you can take to increase the share of the
rainfall, which would become available for plant production?

Diagram 1. Agro-hydrological cycle of an orchard
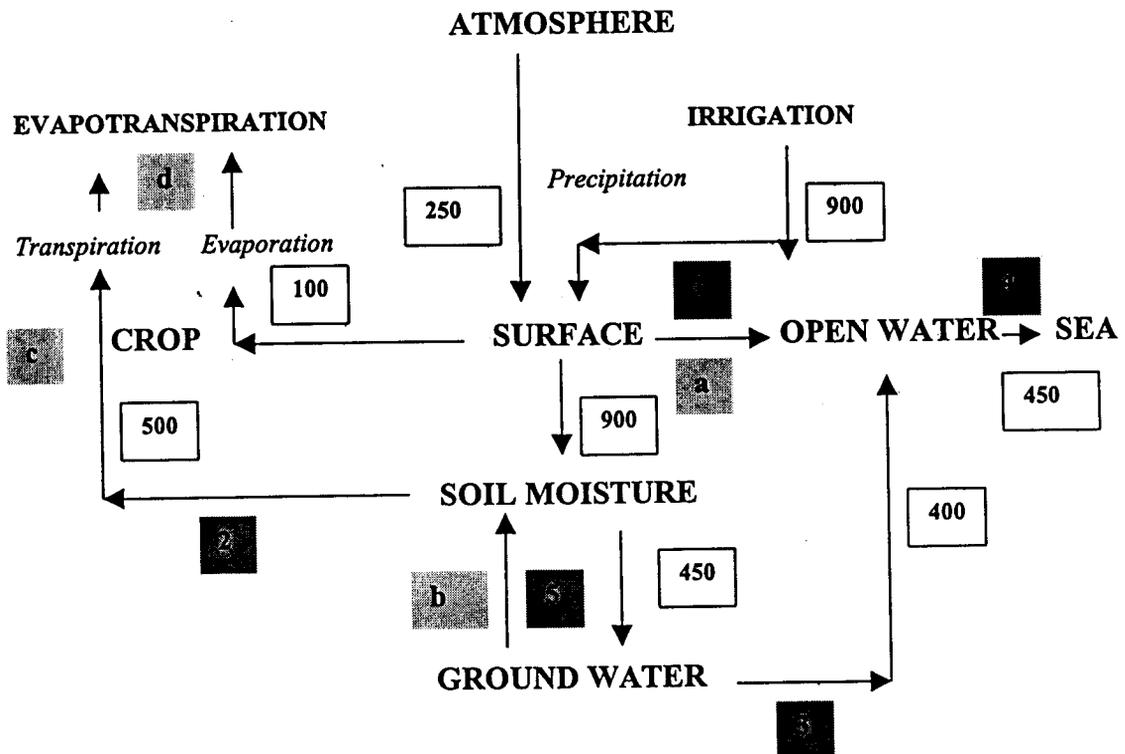
QUESTION 2

(a) Evapo-transpiration is an important parameter in agricultural production;
    (i)   By what factors is the magnitude of evaporation controlled?
    (ii)   What means are available to estimate and/or measure evaporation either directly or indirectly?
    (iii)   What correction factors are required to convert directly or indirectly determined evaporation into evapo-transpiration of crops?

(b) Surface run-off can be considered as part of that rainfall which does not contribute directly to the crop water requirement; but it contributes largely to the discharge in streams and rivers
    (i)   Mention and describe the five major characteristics which determine run-off
    (ii)   Mention and describe the three methods of run-off estimation
    (iii)   What is a run-off hydrograph?

QUESTION 3

(a) Define the following terms;
    (i)   Draw-down of a borehole
    (ii)   Piezo-metric head of a borehole
    (iii)   Radius of influence of a borehole
    (iv)   The N30 value of rainfall
    (v)   Rainfall duration curve

(b) (i)   List three properties of a fluid
    (ii)   Describe the two types of flow

(c) Define the following terms used in connection with the flow of a liquid
    (i)   Uniform flow
    (ii)   Steady flow
    (iii)   Unsteady flow
    (iv)   Mean velocity
    (v)   Discharge

(d) What is meant by continuity of flow and under what conditions does it occur?

QUESTION 4

(a) State Bernoullis theorem for a liquid
(b) State the forms of energy which a liquid in motion can possess
(c) A jet of water from a 25mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting a loss of energy, what will be the diameter of the jet at a point 4.5 metres above the nozzle if the velocity with which the jet leaves the nozzle is 12 m/sec?
(d) The Chezy formula $v=C\sqrt{(mi)}$ assumes that the frictional resistance to flow in an open channel is proportional to the square of the mean velocity, in which v is the mean velocity of flow, m is the hydraulic mean depth, i is the bed of the channel, and C is the resistance coefficient
    (i)   Define the wetted perimeter
    (ii)   Define the mean depth

(iii)   A rectangular open channel has a width of 4.5 metres and a slope of 1 vertical to 800 horizontal. Find the mean velocity of flow v and the discharge Q when the depth of water is 1.2 m, if C in the Chezy formula is 49 in S.I units?

QUESTION 5

(a) What are the main attributes to the losses of energy in a pipeline?
(b) What is the most convenient formula used to estimate frictional loss in a pipeline?
(c) What are the two instruments/equipment used to apply Bernoulli's equation in flow measurements?
(d) What are the two devices commonly used for flow measurements in open channels?
(e) (i)   What is a pump and describe the types of pumps available for irrigation purposes?
    (ii)   What are the five pump performance parameters?
    (iii)   What is the difference between a pump and a turbine?

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

MAY 2000

AGS 452 PRINCIPLES OF LAND HUSBANDRY

TIME: 3 HOURS   MARKS: 100

ANSWER: ALL QUESTIONS

1. Discuss the importance of climate and soils as aspects of the natural environment which must be cared for. [10 marks]

2. Explain clearly why the soil is a key primary resource in agricultural production. [10 marks]

3. Discuss how good interactions between farmers and outsiders (technical officers) can help improve land husbandry practices. [10 marks]

4. Explain why conservation practices should be integrated into farming systems and not managed as separate practices. [10 marks]

5. Discuss the reasons why land husbandry strategies which have been successful in one area may fail in another. [10 marks]

6. In working with farmers for better land husbandry, one may choose an area as defined by topography. e.g. a catchment . What are the advantages and disadvantages of such an approach? [10 marks]

7. Discuss five (5) economic investments which once put in place may help planted pastures to be more productive than the native vegetation [10 marks]

8. (a)   What is "Optimum stocking rate"?

    (b)   What is "Optimum forest product off-take rate"?

    (c)   Discuss the general strategy for maintenance of a healthy and productive vegetative cover of grass (for grazing) and trees. [10 marks]

9. You have been employed by an NGO in Lusitu as a Land Management Specialist to assist in curbing erosion in Sianzembwe Village which is reported to have serious problems of wind erosion. If you are given a 5 - year contract on the project, what measures would you propose to the local community as a means of arresting wind erosion? Justify your choice of measures with scientific reasons. [10 marks]

10. List the factors that affect sheet erosion, and discuss in detail how 3 of these affect sheet erosion. [10 marks]

END OF EXAM

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

May 2000

AGS 462
SOIL PHYSICS FOR AGRICULTURAL ENGINEERING

TIME: THREE HOURS

MARKS: 100 AND ALL Questions carry equal marks

<u>Answer all questions. Be precise. Scientific calculators are allowed</u>.

QUESTION 1

(b) What is soil consistency and what are the different forms?

(b) (i)   What is the significance of the Atterberg limits?

      (ii)   What factors affect the Atterberg limits?

(c) (i)   What is shear strength of a soil?

     (iii)   Determine the value of C and Φ for sample used in direct shear test. Observations made at failure in the laboratory are;

<u>Normal Stress</u>	<u>Shear Stress</u>
1 kg/cm^2	0.905 Kg/cm^2
1.5 kg/cm^2	1.05 kg/cm^2
2.5 kg/cm^2	1.30 kg/cm^2

(d) (i)   What are the factors affecting capillary conductivity?

     (iii)   What is the importance of capillary rise?

QUESTION 2

(a) From the curve (*Diagram 1*) below estimate the following

     (ii)   Proportion of total work required for cutting through the soil at minimum and maximum speed?

     (iii)   Proportion of total work required for over-coming cohesion and shear forces at minimum and maximum speed?

     (iv)   Proportion of the total work required for the other tillage aspects at minimum and maximum speed?

(b) What is the major dynamic property of a soil involved in soil-machine interactions?

(c) What is scouring and what factors cause non-scouring of soil?

Diagram 1. Relative contribution of cutting, sliding friction and shear plus acceleration to draft of an inclined tool
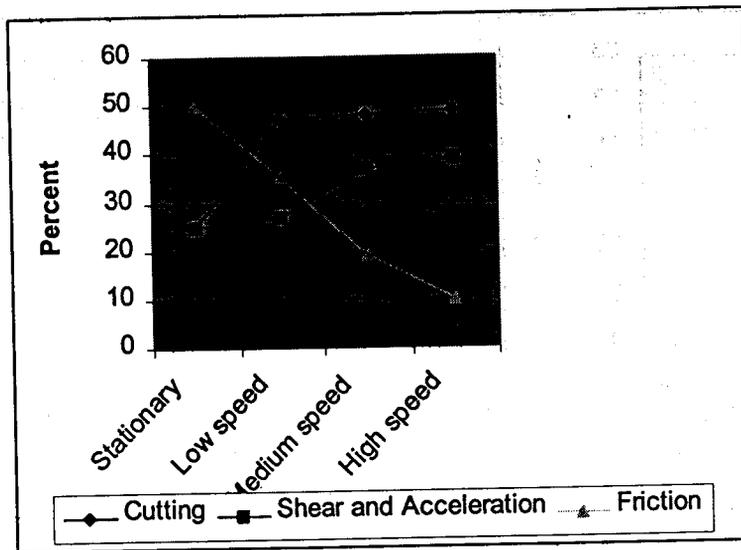
QUESTION 3

(a) Give an explanation of the moisture characteristic of a soil on the basis of its suction?
(b) What is the hysteresis phenomenon in the pF-moisture relation?
(c) From the diagram/graph/curve below (*Diagram 2*);
    (i)   Determine or describe points 1,2,3,4,5, and 6
    (ii)   What is readily available soil moisture and by what aspects is it determined?

Diagram 2. The Characteristics of the pF-curve

Diagram 2. The Characteristics of the pF-curve
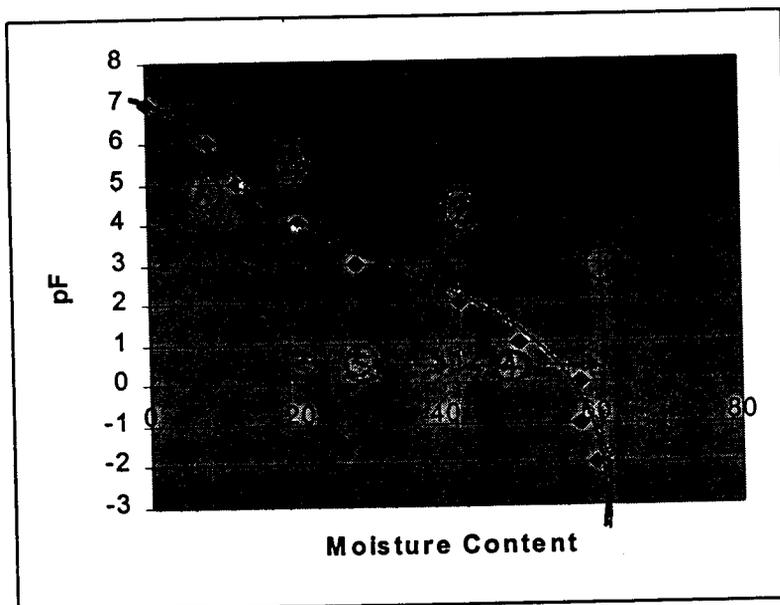
QUESTION 4

(a) (i) What is the hydraulic conductivity for water in the soil?

(ii) What factors determine the value of the hydraulic conductivity?

(iii) Mention two methods used to determine the hydraulic conductivity in the laboratory?

(iv) A sample was tested in a constant head permeameter. Soil sample is 5cm high and 8 cm in diameter. Water percolates through the soil under a constant head of 45 cm for 8 minutes. The water was collected and weighed and its weight recorded as 500gms. Calculate the hydraulic conductivity? [*Given the hydraulic conductivity is equal to the product of the volume and length of sample divided by the product of the head, area and time*]

(b) (i) The mean composition of soil air varies with what five factors?

(ii) Describe the two types of pores involved in soil aeration?

(iii) What are the two main processes involved in the replacement of soil air?

QUESTION 5

(a) Water movement in a soil takes place under influence of potential differences

(i) Describe the various component potentials to which moisture in a soil is subjected?

(ii) What is the major potential for saturated ground water flow?

(iii) What is the major driving potential for unsaturated soil moisture flow?

(b) (i) When a dry soil is inundated or wetted, what zones of soil layers would you get as water infiltrates the soil?

(ii) Which equations would you use to determine the flow for a short and long duration infiltration?

(iii) Define and describe a storage coefficient of a soil profile after water has infiltrated into it

(iv) What are the physical factors affecting radiation distribution?

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

UNIVERSITY SECOND SEMESTER EXAMINATIONS

MAY 2000

AGS 522 SOIL AND PLANT ANALYSIS

TIME: 3 HOURS
MARKS: 100
ANSWER ALL QUESTIONS

1.   Explain the four (4) phases of soil testing [10 marks]

2.   Disucss the following terms in relation to soil sampling in case of a, b, c, and e and plant sampling in the case of d.
    (a)   Sample representativeness
    (b)   Contamination
    (c)   Site information
    (d)   Sampling appropriate plant parts
    (e)   homogeneous sampling units   [20 marks]

3.   Explain the following two concepts of fertilization and discuss their advantages.

    (a)   Rapid build-up and maintenance
    (b)   Sufficiency level   [10 marks]

4.   Given the following information:
    Atomic masses of
$$H = 1$$
$$Na = 23$$
$$Ca = 40$$
$$K = 39$$
$$Cl = 35.5$$
$$O = 16$$
$$P = 31$$

    (a)   What is the percent concentration of 25g $CaCl_2$ dissolved in a final volume of 450ml? [1 mark]

    (b)   What is the concentration (in molarity) of 10g of NaCl dissolved in 100 ml water?

    (c)   Calculate the amount of NaCl used to prepare a 0.05 M NaCl solution. [1 mark]

    (d)   If one dissolves 2.0 g of Dipotassium phosphate (K_2HPO_4) into one(1) litre of water, what is the concentration of K in the solution? Give the answer in ppm and

show the different steps of calculation. [9 marks]

(e) What is the amount of calcium hydroxide $Ca(OH)_2$ required to prepare an equivalent solution? [2 marks]

5. (a) Given the following information about suphuric acid:
concentration = 96%
molecular weight = 98
specific gravity = 1.84
What is the voulme of sulphuric acid needed to prepare a one normal solution? [3 marks]

(b) If 25mg of zinc is dissolved in a litre of water, what is the concentration of zinc in ppm? [2 marks]

6. (a) What is lime requirement? [2 marks]

(b) Discuss the use of pH measurement in the determination of lime requirement and discuss the advantages and disadvantages of this method. [4 marks]

(c) Generally describe four (4) different methods that may be used in the determination of lime requirement. [4 marks]

7. (a) Discuss the five(5) basic mechanisms of P removal from the soil by extractants. [10 marks]

(b) Explain five (5) physical factors which affect the extraction of available phosphorus. [10 marks]

8. Generally describe the methods used to determine Zn, Cu, Mn, Fe, B and Mo, mentioning the main extractants in use in the world for each of these elements. [10 marks]

END OF EXAM

QUESTION 3

(a) Using a suitable explain the operation of a hydraulic ram pump? **(8 points)**

(b) A propeller turbine has a shape number $\varphi = 4$ and produces 200 kW (mechanical) at a working head of 10 m. Its efficiency is about 70%. Calculate
   (i) The flow rate. **(6 points)**
   (ii) The angular speed of the shaft. **(6 points)**

QUESTION 4

(a) Derive the expression for power developed due to wind. **(3 points)**

(b) What are the main considerations in selecting a site for wind generators? **(4 points)**

(c) Wind at 1 standard atmospheric pressure and at 15 C temperature has a velocity of 15 m/s. The turbine has a diameter of 100 m and its operating speed is 40 revs/min at maximum efficiency. *Calculate*

   (i) The total power density in the wind stream, **(3 points)**
   (ii) The maximum obtainable power density assuming $\eta = 40\%$, **(3 points)**
   (iii) The total power produced (in kW), and **(3 points)**
   (iv) The torque and axial thrust. **(4 points)**

QUESTION 5

(a) What is the difference between biomass and biogas? **(3 points)**

(b) Write the main applications of biogas. **(3 points)**

(c) Design a community biogas plant for a village consisting of 90 families, each family consisting of five persons (adults). Village survey report gives the following information about animals.

Cows	102
Oxen	124
Buffalo	52
Pigs	3

Assume that gas required for cooking/person /day = 0.227 m^3
Gas required for lighting 100 C.P lamp per hour = 0.126 m^3
Each family is allotted one lamp which would burn for 2 hours daily. **(14 points)**

QUESTION 6

(a) What are the advantages and disadvantages of renewable energy sources? **(4 points)**

(b) Write short notes on beam and diffuse radiation. **(6 points)**

(c) Define solar constant. **(3 points)**

(d)   What are the reasons for the variation in solar radiation reaching the than received at the outside of the atmosphere? **(7 points)**

QUESTION 7

(a)   Calculate the sunset hour angle and day length at a location latitude 15 S, on June 22. **(8 points)**

(b)   The following data are given for a family biogas digester suitable for the output of 8 cows: the retention time is 20 days, temperature 30 C, dry matter consumed per day = 2 kg, biogas yield is 0.24 m³ per kg. The efficiency of the burner is 60%, methane proportion is 0.8. Heat of combustion of methane = 28 MJ/ m³ plant. **(12 points)**

END OF THE EXAMINATION   **GOOD LUCK (njk/2000)**

USEFUL EQUATIONS

$$\cos\theta = \sin\phi(\sin\delta\cos S + \cos\delta\cos\gamma\cos\omega\sin S) + \cos\phi(\cos\delta\cos\omega\cos S - \sin\delta\cos\gamma\sin S)$$
$$+ \cos\delta\sin\gamma\sin\omega\sin S$$
$$\cos\theta_z = \cos\phi\cos\omega\cos\delta + \sin\phi\sin\delta$$

$$\cos\gamma_s = \sec\alpha(\cos\phi\sin\delta - \cos\delta\sin\phi\cos\omega)$$

$$\sin\gamma_s = \sec\alpha\cos\delta\sin\omega$$

$$<\tau\alpha>= \frac{\tau.\alpha}{1-(1-\alpha)\rho_d}$$

$$H_o = \frac{24}{\pi}I_{sc}\left[\left\{1+0.033\cos\left(\frac{360n}{365}\right)\right\}\left(\cos\phi\cos\delta\sin\omega_s + \frac{2\pi\omega_s}{360}\sin\phi\sin\delta\right)\right]$$

$$P_{max} = \frac{8}{27}\rho A V^3$$

$$\Im = \frac{P_m^{1/2}w}{\rho^{1/2}(g H_a)^{5/4}}$$

3

TIME ALLOWED: THREE HOURS

INSTRUCTIONS: ATTEMPT **FOUR** QUESTIONS ONLY, **AT LEAST** ONE FROM EACH OF THE **THREE** SECTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

SECTION A

Question 1

a) State **three objectives** of mechanising field operations.

[6 marks]

b) A rotary cultivator is suitable for minimum tillage operation especially in soils with high clay content. State **three** ways of how the break up of clods may be intensified when using a rotary cultivator.

[6 marks]

c) Briefly explain why a good seedbed should have a granular soil structure on the surface and fine soil particles at the depth where the seed need to be placed?

[4 marks]

d) With the help of a sketch of a tandem disk harrow, briefly explain its action and effects on the soil.

[4 marks]

e) Explain what the term "**soil solarisation**" mean.

[5 marks]

Question 2

a) Define the following terms:
   i) Integrated Pest Management
   ii) Pesticide formulation
   iii) Drift

[6 marks]

b) Give **two** advantages and **two** disadvantages of chemical pest control.

[4 marks]

c) State the key characteristic of a positive displacement pump that makes it particularly suitable for use on high-pressure sprayers.

[4 marks]

d) At a deposition level 500mm below the tip of an even flat-fan spray nozzle, the discharge rate across a lateral distance of 42cm each side of the nozzle centre line, is constant at 30 ml/min per centimetre.
   i) Determine the nozzle flow rate.

[2 marks]

ii)   Calculate the nozzle spray angle.

[3 marks]

iii)   If nozzles with this spray pattern are spaced 1m apart on the boom, what tip height above the deposition level would give uniform coverage?

[3 marks]

iv)   Given a field application rate of 300 l/ha, calculate the required sprayer forward speed.

[3 marks]

SECTION B

Question 3

a)   Figure Q3 shows the relationship between implement width, rate of work and field size. Draw the correct conclusion about the relationship as indicated by the graph.

[5 marks]
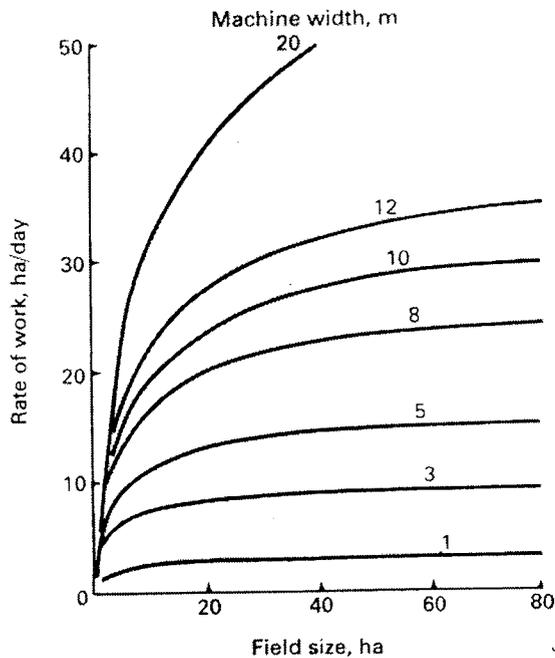
Figure Q3

b)   A 4.5 m width of cut self propelled combine harvester makes an average stop of 5 minutes every time its 3 tonne grain tank is full and need to be offloaded. This stop includes the time for adjustments, lubrication, refuelling and the operators personal time. The gross yield of the field is about 6.3 tonnes/ha. Grain loss during harvesting is estimated at 300 kg/ha by an electronic monitor on-board the combine harvester. The average operating speed is 4.5 km/h. The time for turning on the headland, (at the end of the 500 m field) is 45 sec. The average actual width of cut of the combine head is 0.90 of the rated width. Determine:

i)   Theoretical field capacity
ii)   Effective field capacity
iii)   Percentage time loss
iv)   Field efficiency
v)   Material capacity

[15 marks]

c)   State **five** types of crop losses associated with combine harvesting of Soya beans.

[5 marks]

Question 4

Figure Q4 shows a tractor and a three furrow plough. The depth of ploughing is controlled by a depth wheel running on the ground surface.
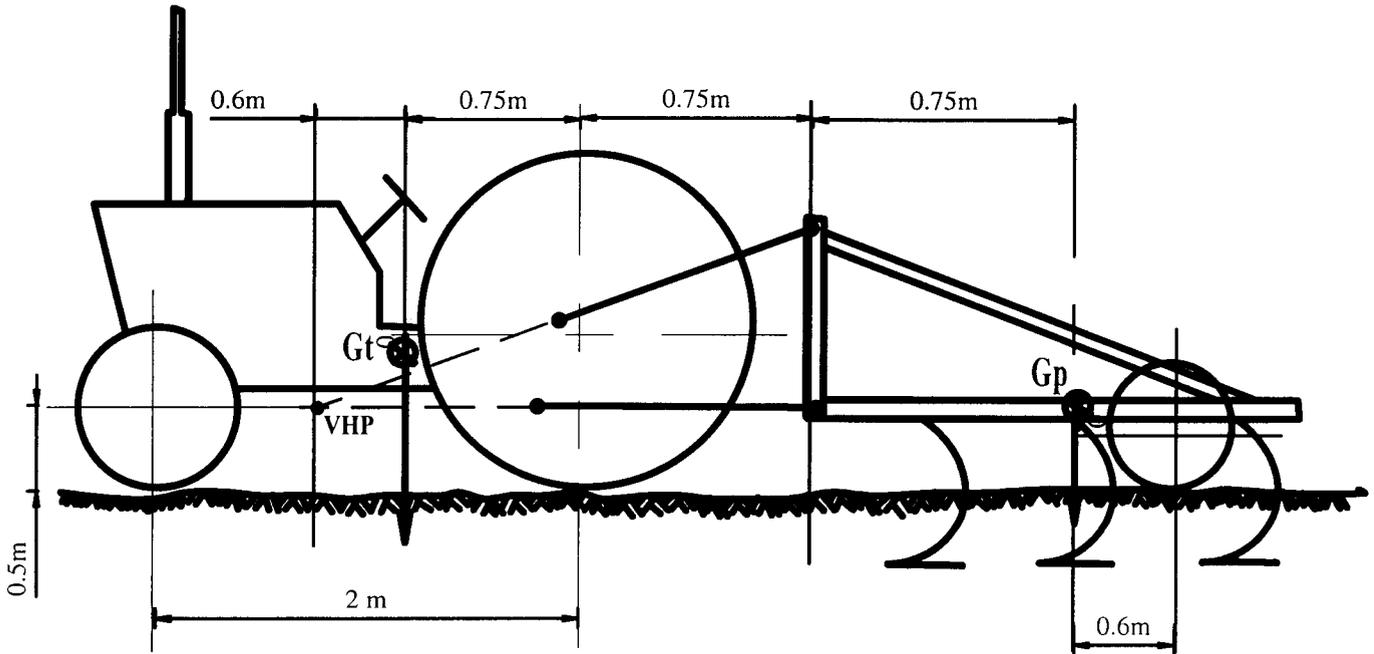
NOT TO SCALE

Figure Q4

Given the following information:

Weight of the tractor, Gt	20kN
Weight of the plough, Gp	3kN
Draught force on each plough body	2500N
Side force on each plough body	500N
Coefficient of rolling resistance on the tractor rear wheels	0.1
Coefficient of rolling resistance on the tractor front wheels	0.12
Coefficient of rolling resistance of plough depth wheel	0.15
Coefficient of landside friction is	0.6
Maximum tractor engine power	39 kW
Gross tractive efficiency	65%

The line of action of the total horizontal soil force on the implement can be taken to act along the ground centre line of the tractor.

Calculate;

i) the vertical reaction on the tractor front and rear wheels and the plough depth wheel.

[12 marks]

ii) the thrust required at the tractor driven wheels.

[5 marks]

iii) the coefficient of traction (drawbar pull/load on driven wheels).

[4 marks]

iv) maximum tractor operating speed on a level field.

[4 marks]

SECTION C

Question 5

a) A farmer, with 750 hectares of arable land would like to acquire a sprayer with an 8m wide boom. The sprayer is expected to be used twice a year to spray various chemicals over the entire field. The tractor where the sprayer will be mounted spends an additional 750 hours a year carrying out other field operations. Assume sprayer operating speed of 10.5 km/h and field efficiency of 65%. Additional information is provided in the table below:

	Tractor	Sprayer
Purchase price, P	K 60,000,000	K 6,500,000
Trade-in value, S	10% P	0
Shelter/Insurance/Tax	1.5% P	0.5% P
Depreciation life	12 years	8 years
R&M (cumulative over machinery life)	150% of P	65% of P
Fuel Consumption	15 l/h	-
Price of Fuel	K 2100/l	-
Cost of lubricants	15% of Fuel Cost	
Labour cost is K 750 per hour and the bank interest rate is 35%.		

Calculate the total cost of operating the sprayer per hour and per hectare.

[15 marks]

b) A contractor could be hired to spray the crop as an alternative to buying own sprayer. Assuming a contractor charges a fixed charge of K 100,000 plus K 12,000 per hectare:

i) Calculate the break-even hectarage.

[5 marks]

ii) Identify the minimum cost system if the farmer has to spray the whole field three times per year

[5 marks]

Question 6

a) Consider a farmer who grows 10 ha of basic grains which includes 5 ha of rice. He has been hiring a tractor and implements from a local contractor for tillage and rice planting. Now that the cost of hiring has risen, he suspects that it may be more profitable to acquire draft animals with associated implements to do his tillage and to sow by hand. The farmer also sees an opportunity of hiring out draft animals to other farmers, especially during the off-peak periods. He however realises that he will have to hire additional labour and that his rice yield may suffer as a result of the tillage change. Nevertheless he considers that the change may be advantageous.

The following annual items are the main elements in the decision. Arrange them in partial budget format and state whether the farmer should replace hired tractor, tillage implements and planter with draft animal powered and manual system in 5 ha of rice

i)	Draft animal implements fixed costs	K 195,000
ii)	Draft animal implements, operating costs	K 76,000
iii)	Oxen maintenance cost	K 124,000

iv)	Tractor hire, ploughing, 5 ha @	K 90,000/ha
v)	Tractor hire, harrowing, 5 ha @	K 60,000/ha
vi)	Tractor hire, planting, 5 ha @	K 40,000/ha
vii)	Labour for ADP; ploughing 5 ha @ 2.5 days/ha	K 6,000/day
viii)	Labour for ADP, harrowing 5 ha @ 1 day/ha	K 6,000/day
ix)	Manual labour, planting 5 ha @ 1 day/ha	K 6,000/day
x)	Reduction in rice yield due to change in tillage system	500kg/ha
xi)	Market value of rice	K 1,500/kg
xii)	Net revenue from hiring out oxen	K 350,000

[12 marks]

b) List **two** disadvantages of using hired service for agricultural operations.

[4 marks]

c) State the advantage of using Discounted Cash Flow method in appraising agricultural machinery investment projects?

[3 marks]

d) List **three** situations that may necessitate replacement of farm machinery

[6 marks]

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SECOND SEMESTER UNIVERSITY EXAMINATIONS MAY 2000

EA522 FARM STRUCTURES II

INSTRUCTIONS:

ANSWER: ANY FIVE QUESTIONS
TIME: THREE (3) HOURS

THIS EXAMINATION PAPER CONTAINS SIX QUESTIONS
ALL QUESTIONS CARRY 20 MARKS
THE MARKS FOR EACH QUESTION ARE GIVEN IN BRACKETS

QUESTION 1

(a)   Explain in brief the effects of the following climatic factors on livestock
       structures.   **(12)**
       (i)   Temperature
       (ii)   Relative humidity
       (iii) Solar radiation

(b)   Consider that moist air enters a pig house at 10°C dry bulb temperature and 70%
       relative humidity replacing air removed from the space by an exhaust fan. If the
       air leaves at a rate of 0.5m³/s, and 25°C dry bulb temperature and 80% relative
       humidity.
       (i)   How much sensible heat in joules is added every hour?   **(2)**
       (ii)   How much latent heat in joules is added every hour?
                  (2)
       (iii) If the moisture production of the pigs is estimated at 120 grams/hr, find
              the number of pigs in the building.   **(4)**

       Use the psychrometric chart provided and use the conditions at exhaust to
       estimate the density of air.

QUESTION 2

(a) An agricultural building in Zambia houses livestock whose upper comfort limit is as shown on the solar chart.

    (i) Find the shading angles for the north-west and south-west walls of the building. **(6)**

    (ii) How many hours is the north-east wall exposed to the sun rays on 10 December. **(2)**

(b) The following meteorological elements affect farm buildings in Zambia. Discuss each one briefly using not more than two paragraphs: **(6)**

    (i) Wind in Zambia.

    (ii) Rainfall in Zambia.

(c) Discuss the orientation of farm buildings in Zambia and suggest structural ways of dealing with problems associated with overheating due to solar heat gain. **(6)**

QUESTION 3

(a) Make simple sketches of designs of three (3) types of air inlets for ventilation systems suitable for eaves or ridge positions in agricultural buildings. **(6)**

(b) The description of a pig house is as follows:

Animal data:
Number of pigs   = 360   Average weight = 62kg
Sensible heat production/pig = 98 watts
Moisture production/pig   = 112 grams/hr

The structural heat loss data:

Item	Area (m^2)	U-Value (W/m^2°C)
Roof	306	1.0
Wall	170	0.8
Floor	300	0.5

For air, c_p = 1.005 kJ/kg°C and ρ = 1.2 kg/m^3.

For a ventilation rate of 0.2 m^3/hr.kg of pigs and outside temperature and relative humidity of 16°C and 60% respectively, calculate:

    (i) The temperature inside the house. **(6)**

    (ii) The relative humidity inside the house **(4)**

    (iii) When the ouside temperature is 20°C, what is the ventilation rate in m^3/hr.kg pig required to maintain the inside temperature at 23°? **(4)**

Use the pychrometric chart provided.

QUESTION 4

(a)   Differentiate between durable and semi-perishable crops giving their
        characteristics with respect to storage requirements.   **(6)**

(b)   Discuss the requirements for a broiler house with respect to
        (i)   Temperature   **(2)**
        (ii)   Lighting   **(2)**
        (iii)   Ventilation   **(2)**

(c)   Describe two (2) housing systems for layers suitable for a medium-scale producer.
                                                                             (8)

QUESTION 5

A farmer is considering investing in a dairy production unit with a free-stall housing
system and milking parlour. There are two schemes that have been proposed for the
enterprise. The returns from milk sales and the occasional sale of calves and culled
animals are expected to be the same from both schemes. The schemes are as follows (all
figures in million kwacha):

	Scheme A	Scheme B
Capital costs	132	50
Annual cost of feed, veterinary services, etc.	20	25
Annual maintenance costs estimated at year 0,		
expected to rise at 2.75%/year	5	8
Annual cost of operating staff	0.5	0.8
Annual cost of administration	0.5	0.8

The proposals also include upgrading the milking parlour in the tenth year of operation to
increase milk production. The costs for the upgrade are:

	Scheme A	Scheme B
Capital cost of upgrade	15	15
Extra annual cost of feed, veterinary services, etc.	2	2
Extra annual maintenance costs estimated at year 0,		
expected to rise at 2.75%/year	1.5	1.0
Annual cost of operating staff	0.5	0.8
Annual cost of administration	0.5	0.8

Using an interest rate of 9% to represent the value of money, compare these schemes on a
present worth basis and determine which is the more economical over a period of twenty
years.   **(20)**

QUESTION 6

(a) What are the eight (8) main reasons for introducing planning at the rural settlement level?

(8)

(b) Explain 4 reasons why agricultural buildings are not normally subject to strict building regulations in most countries.

(4)

(c) The rainwater harvesting installation for a pig production unit has the following water collecting regime:

Month	Water collected (litres)
Nov	6,000
Dec	8,000
Jan	12,000
Feb	14,000
Mar	7,000
Apr	2,000
May	0
Jun	0
Jul	0
Aug	0
Sep	0
Oct	0

If the tank is designed to equate inflow and outflow for the year, and the average consumption from the storage tank is expected to be 15 litres per day per animal:

(i) Find the required storage capacity to supply water throughout the year. **(6)**

(ii) What is the maximum number of pigs that can be supplied by this tank? **(2)**

THE UNIVERSITY OF ZAMBIA

UNIVERSITY EXAMINATIONS – MAY 2000

EA 542: IRRIGATION ENGINEERING

TIME: THREE HOURS

INSTRUCTIONS: ATTEMPT (5) QUESTION ONLY

ALL QUESTION CARRY EQUAL MARKS

QUESTION 1:

Given the following data for the soil profile of an irrigated field which consists of three horizons:

		A	B	C
(i)	horizon	A	B	C
(ii)	thickness of horizon, cm	5	15	60
(iii)	bulk density, g/cm^3	1.2	1.3	1.4
(iv)	initial moisture content (mass basis), %	5	10	15
(v)	field capacity of horizon (volumetric moisture content), %	30	33	36

a) Plot the resultant moisture content of the profile if 10.2 cm of water is added. Assume that the horizon interfaces do not impede flow and that drainage from the C horizon is not impeded.

[9 marks]

b) Assuming that a shallow rooted crop is being grown on the field (therefore consider only the A and B horizons as the soil moisture reservoir), how long will it take to deplete the reservoir to 50 % of capacity if the Evapotranspiration (ET) rate is 4 mm/day and both A and B horizons are initially at field capacity?

[4 marks]

c) How much water (mm) will have to be applied at that time if the irrigation is 64% efficient?

[2 marks]

d)   If a rainfall of 15 mm occurs on the 5th day, how soon thereafter will irrigation be required? Assume that 80 % of the rainfall is effective and infiltrates to the A and B horizons. Irrigation is provided when both A and B horizons are at 50 % of field capacity.

[5 marks]

QUESTION 2

a)   Briefly define the following terms:

(i)   Surface drainage
(ii)   Subsurface drainage
(iii)   Relief drains
(iv)   Hydraulic conductivity
(v)   Deferred drainage   [5 marks]

b)   The ground water table at the Nakambala Sugar Estates has severely risen after thirty-four years of surface irrigation creating high water tables in the rainy season. After heavy rain storms the water tables have been observed to rise to the ground surface. As an Agricultural Engineer you are required to calculate the drain spacing which must lower the water table to 0.8 m below the ground surface within four days after a rain storm for the following Nakambala soil conditions:

Hydraulic conductivity of the soil profile	$K = 2.0$ m/day
Drainable porosity of the soil	$\mu = 0.05$
Wetted perimeter of the drain	$u = 0.30$ m
Depth of the impermeable layer below the drainage base	$= 4$ m
Depth of the drainage base	$= 1.2$ m

[5 marks]

c)   For the drainage of an irrigated area in Central Province, drain pipes with a radius of 0.1 m will be used. They will be placed at a depth of 1.8 m below the soil surface. A relatively impermeable soil layer was found at a depth of 6.8 m below the soil surface. From auger hole tests, the hydraulic conductivity above this layer was estimated as 0.8 m/day. Irrigation is applied approximately every 20 days. The average losses, which recharge the already high water table, amount to 40 mm.
What drain spacing must be applied when an average water table depth of 1.20 m below the soil surface is to be maintained? [Use the table (L vs D) provided to find the equivalent depth].

[10 marks]

QUESTION 3

a)   Write a note (about 100 words) on the nature and effect of cavitation.

[5 marks]

b)   What is the function of a pump in any hydraulic system?   [2 marks]

c)   Water is being pumped from a reservoir into a 25 cm diameter pipe and conveyed to a sprinkler irrigation system.   A pressure gauge located immediately downstream of the pump reads 600 kPa.   The surface of the reservoir is 2.5 m below the centre line of the pump.   The system design capacity is 4000 L/min. The total friction loss in the suction line and fittings is 1.68 m. Determine the brake power requirement of the pump if it is 69 percent efficient.

[5 marks]

d)   A centrifugal pump is installed along side a river, 800 m above sea level to pump water at a temperature of 20 $^\circ$C. The suction line losses (friction + minor losses in the suction pipe and foot valve) are 0.5 m. The objective is to install the pump on the river bank, 4.5 m above the minimum water level in the river.   Determine whether the required NPSHr of 5.2 m (from the pump characteristic curve) can be met and also what the maximum suction-side lift of the pump is in the present instance.

[8 marks]

QUESTION 4

a)   Selection of an irrigation system for a specific application is not an easy task. List 8 factors that play a part in the selection of an irrigation system.

[2 marks]

b)   List 3 most common and serious soil problems caused by irrigation. Itemize the possible remedies for each problem.

[3 marks]

c)   What are the advantages and disadvantages of a furrow irrigation system.

[4 marks]

d)   A 24 ha field of sugar cane is to be irrigated by the furrow method. The runs are 300 m long, the average slope is 0.75 % and the rows are spaced 80 cm apart. The effective root zone is 90 cm deep. The available moisture holding capacity is 17 cm/m depth.   The water application efficiency is 60 %. The field is to be irrigated when 45% of the available moisture is depleted. The whole field is to be irrigated in 13 days and the maximum non-erosive furrow stream is to be used. The irrigator uses 3 cm diameter plastic siphon tubes.

(i)   How many furrow rows are irrigated at each setting?
[8 marks]

(ii)   If one siphon is used per furrow, what head (i.e., water surface elevation in the ditch to water surface elevation on the field) would be need? Assume C = 0.65.   [3 marks]

QUESTION 5

a)   Prove the following statement:

"To double the quantity of water flowing over an overflow-type control structure, the depth must be increased only 1.6 times".
[2 marks]

b)   Consider a trapezoidal channel, having the following dimensions: bottom width, 6.0m; side slope of 3 horizontal to 1 vertical; depth of water, 0.99 m; discharge capacity of channel, 10.8 m^3/s. The channel carries water from a point with elevation 235.8 m to a recipient water body of 204 m water level. Determine the required channel length if n = 0.025.
[8 marks]

c)   A flow of 0.8 m^3/s is diverted for one full day a week to a farm storage reservoir. From this reservoir water is continuously diverted to irrigate a 50 ha farm. The main canal from the reservoir to the farm is 2000 m long and is unlined. The daily crop water requirement during the peak demand is 10 mm/day. The losses in the irrigation canal are 1.0 litre per minute per metre canal. The evaporation and seepage losses of the reservoir are 6 m^3 per hour. Determine:

(i)   the reservoir storage efficiency, er   [3 marks]

(ii)   the conveyance efficiency, ec   [3 marks]

(iii) the application efficiency, ea   [3 marks]

(iv)   the overall efficiency, es   [1 mark]

QUESTION 6

a) Illustrate with the aid of schematic sketch the four main components of a sprinkler irrigation system. [3 marks]

b) A sprinkler irrigation system uses two 186 metres long laterals to apply water at a rate of 12.5 mm/h. Sixteen sprinklers are spaced at 12 m intervals on each lateral. The spacing between the laterals is 18 m. Allowing 1 hour for moving equipment and the two laterals, how many hours would be required to apply a depth of 50 mm to a square 16-hectare field? How many 11-hour days are required (i.e., the farm workers only work 11 hour per day)?

[8 marks]

c) In order to evaluate the irrigation system performance, the irrigator used catch cans located in a square grid throughout the field. The data in the table are depths of catch (in mm) at 25 observation points. Check if the sprinkler system performance is satisfactory by evaluating the uniformity coefficient.

40	33	41	36	34
37	31	40	29	32
34	26	27	41	29
41	28	38	34	40
30	38	34	31	33

[9 marks]

QUESTION 7

a) Write short notes on the following terms:

(i) Impact sprinklers

(ii) Low pressure sprinklers

(iii) Pipe couplers

(iv) Distribution pattern (of a sprinkler discharge) [4 marks]

b) Briefly explain the five major factors considered when choosing a sprinkler irrigation system. [5marks]

c) The following data is from a farm irrigated by a hand move sprinkler system.

Area of farm to be irrigated	=	39.6 ha
Peak crop irrigation water requirement	=	7.6 mm/day
Net irrigation application depth	=	53.2 mm
Sprinkler spacing on lateral	=	12.2 m
Lateral spacing	=	18.3 m
Length of lateral lines	=	393.4 m
Number of laterals	=	5
Time required to move laterals	=	0.5 h
Application time per lateral setting (set-time)	=	11.5 h
Water application efficiency	=	75%

(i)   Calculate the total area under irrigation in one 'set' (5 laterals operate at a time)   [1 mark]

(ii)   Calculate the total number of settings required to irrigate the whole farm.

[1 mark]

(iii)   Calculate the irrigation interval.   [1 mark]

(iii)   Calculate the system capacity (total discharge of the five laterals).

[3 marks]

(iv)   If the cumulative infiltration equation derived from infiltrometer tests is:

$$I_{cum} = T^{0.65}$$

Where I_{cum} = cumulative infiltration in mm

T = application time in minutes

Check whether the sprinkler intensity towards the end of each setting would cause surface ponding and/or runoff.

[5 marks]

TABLE 7.1   *Equivalent depth 'd' for commonly used pipe drains* ($r_o = 4{-}10$ cm; $u \simeq 0.3$ m)

D(m) \ L(m)→	5	7·5	10	15	20	25	30	35	40	45	50	75	80	85	90	100	150	200	250
0·50	0·45	0·50	0·50	0·50	0·50	0·50	0·50												
0·75	0·60	0·65	0·70	0·70	0·75	0·75	0·75	0·75	0·75	0·75	0·75								
1·00	0·65	0·75	0·80	0·85	0·90	0·90	0·95	0·95	0·95	0·95	0·95	0·95	0·95	0·95	1·00	1·00	1·00	1·00	1·00
1·25	0·70	0·80	0·90	1·00	1·05	1·10	1·10	1·15	1·15	1·15	1·15								
1·50		0·90	0·95	1·10	1·20	1·25	1·30	1·30	1·35	1·35	1·35								
1·75		0·90	1·00	1·20	1·30	1·40	1·45	1·50	1·50	1·55	1·55								
2·00			1·10	1·30	1·40	1·50	1·55	1·60	1·65	1·70	1·70	1·80	1·80	1·80	1·85	1·85	1·90	1·90	1·95
2·25			1·15	1·35	1·50	1·70	1·70	1·75	1·80	1·85	1·85								
2·50				1·40	1·55	1·70	1·80	1·85	1·95	2·00	2·00								
2·75				1·40	1·65	1·75	1·90	2·00	2·05	2·10	2·20								
3·00				1·45	1·65	1·85	1·95	2·10	2·15	2·25	2·30	2·50	2·50	2·55	2·55	2·60	2·70	2·80	2·85
3·25				1·50	1·70	1·90	2·05	2·15	2·25	2·35	2·40								
3·50				1·50	1·75	1·95	2·10	2·25	2·35	2·45	2·55								
3·75				1·50	1·80	1·95	2·15	2·30	2·45	2·55	2·65								
4·00					1·80	2·00	2·20	2·35	2·50	2·60	2·70								
4·50					1·85	2·10	2·30	2·50	2·60	2·75	2·85	3·05	3·10	3·10	3·15	3·25	3·45	3·60	3·65
5·00					1·90	2·15	2·40	2·50	2·65	2·75	3·00	3·50	3·55	3·60	3·65	3·80	4·10	4·30	4·45
5·50						2·20	2·45	2·60	2·75	2·90	3·15								
6·00							2·50	2·70	2·90	3·00	3·25	3·85	3·95	4·00	4·10	4·25	4·70	4·95	5·15
7·00							2·55	2·80	3·05	3·25	3·45	4·15	4·25	4·35	4·40	4·60	5·20	5·55	5·80
8·00							2·55	2·85	3·15	3·35	3·55	4·40	4·50	4·60	4·70	4·95	5·70	6·15	6·45
9·00								2·90	3·20	3·45	3·65	4·55	4·70	4·80	4·95	5·25	6·10	6·65	7·00
10·00									3·25	3·50	3·75	4·75	4·90	5·05	5·20	5·45	6·45	7·10	7·55
12·50												5·00	5·20	5·40	5·55	5·90	7·20	8·05	8·70
15·00												5·20	5·40	5·60	5·80	6·25	7·75	8·85	9·65
17·50												5·30	5·55	5·75	6·00	6·45	8·20	9·45	10·40
20·00													5·60	5·85	6·10	6·60	8·55	9·95	11·10
25·00													5·75	5·95	6·20	6·80	9·00	10·70	12·10
30·00																	9·25	11·30	12·90
35·00																	9·45	11·60	13·40
40·00																		11·80	13·80
45·00																		12·00	13·80
50·00																		12·10	14·30
60·00																			14·60
~	0·70	0·95	1·15	1·55	1·90	2·25	2·60	2·90	3·25	3·55	3·90	5·40	5·75	6·00	6·25	6·80	9·55	12·20	14·70

Roughly

$d =$ constant for $D > \tfrac{1}{4}L$

$$WP = \frac{QH}{6116}$$

$$h_L = FH_L + M_L$$

$$H_L = \frac{KC_lLQ^m}{D^{2m+n}}$$

$$C_l = 277778, 572888, 610042$$

$$m = 2.0, 1.85, 1.90$$

$$n = 1.0, 1.16, 1.10$$

$$K = (0.285C_2)^{-1.852}$$

$$K = \frac{Ks}{348}$$

$$P_d = P_u - 9.81(h_L \pm \Delta Z)$$

$$A = \frac{60Q}{LS}$$

$$BP = \frac{WP}{Ep}$$

$$VH = \frac{Q^2}{435.7D^4}$$

$$NPSHa = B_aP_r - VP_w - H_L - M_L - VH - SL - DD$$

$$B_aP_r = 10.33 - 1.17 \times 10^{-3}h + 5.55 \times 10^{-8}h^2$$

$$Hs = SL + DL + DD + H_L + M_L + Ho + VH$$

$$q_m = \frac{0.6}{s}$$

$$d = \frac{q \times 360 \times t}{W \times L}$$

$$\frac{h_t}{h_o} = 1.16e^{-\alpha t}$$

$$\alpha = \frac{\pi^2 Kd}{\mu L^2}$$

$$L^2 = \frac{4KH_a^2}{v} + \frac{8K_b dH}{v}$$

$$Q = CA\sqrt{2gh}$$

USEFUL INFORMATION

$$v = \frac{R^{2/3}S^{1/2}}{n}$$

$$Q = 1859bh^{2/3}$$

$$P_d = P_u - 9.81(h_L \pm \Delta Z)$$

$$\frac{P_1}{\rho g} + Z_1 + \frac{V_1^2}{2g} + H_p = \frac{P_2}{\rho g} + Z_2 + \frac{V_2^2}{2g} + H_{L_{1-2}}$$

$$K = (0.285C_2)^{-1.852}$$

$$Cu = 100(1.0 - \frac{\sum x}{mn})$$

Temperature, $^\circ$C	Vapour Pressure, kN/m^2
0	0.61
10	1.23
20	2.34
30	4.24
40	7.38

Aluminium Tubing with couplers each 6.1 m,   Ks = 0.43

Aluminium Tubing with couplers each 12.2 m, Ks = 0.39

Aluminium Tubing without couplers,   Ks = 0.33

END OF EXAMINATION

THE UNIVERSITY OFZAMBIA

EC 935

AGRICULTURAL ECONOMICS

TIME: (3) THREE HOURS

INSTRUCTIONS: **ANSWER QUESTION (1) ONE AND ANY OTHER (2) TWO**.

1. Agricultural growth in less developed countries has stagnated. Discuss the main causes and consequences particularly those applicable to Zambia.

2. The Food Reserve Agency has been operational for some time now. Compare and contrast this institution to the previous parastatals that were involved in agricultural marketing in Zambia.

3. Zambia is richly endowed with vast arable land, climate, etc... Explain in detail at least five agricultural policy instruments that you would recommend to improve agriculture. While doing so, make reference to the current status.

4. There is an influx of imported agricultural produce in Zambia while farmers are complaining of non and or late delivery of agricultural inputs. .Discuss these issues in relation to storage facilities and transportation.

END OF EXAMINATION