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FIRST SEMESTER EXAM PAPER 2003
SCHOOL OF AGRIC

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THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST SEMESTER EXAMINATIONS – AUGUST 2003
AGA 211 – ANATOMY OF FARM ANIMALS

TIME: **3 HOURS**

INSTRUCTIONS: **ANSWER ANY 5 QUESTIONS**

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1.   **Reproduction is a complicated process that involves active participation of the male and female animal. It leads to perpetuation of a species. The process begins with puberty.**
a. What is puberty?
b. At what age does puberty occur in a cow?
c. A cow only accepts mating at a certain period. What is that period called?
d. What signs does the cow show at that time?
e. If you opened a cow's reproductive system at this time, describe the appearance of its primary organs.
f. In the male, the scrotum encloses the primary organ. Describe the scrotum.
g. What is the contribution of the seminal vesicles to reproduction?

2.   **Write notes on any three (3) of the following:**
a. The uterus of the cow.
b. Epithelial tissue classification.
c. Macroscopic and microscopic internal structure of the kidney of a goat.
d. Glandular tissue of mammary glands of a cow.
e. Hind limb of a pig.

3.   **Digestion is the breakdown of foods to small molecules that are absorbed and utilized by body cells. Digestion starts in the mouth.**
a. Write the dental formula of a cow.
b. Describe in detail the fore-stomachs of a goat.
c. What is its function?
d. What is an esophageal groove?
e. In what animals is it found?
f. What part(s) of the chicken's digestive tract is(are) equivalent to the fore-stomachs?
g. Name the secretions produced by the stomach.

4.   **The respiratory system and the cardiovascular system work together to supply oxygen to the tissues and remove carbon dioxide from the tissues.**
a. Describe the mechanism of respiration.
b. Name and describe the major muscles of respiration.
c. Briefly describe the respiratory unit.
d. Compare and contrast veins and arteries.

Turn Over

5. **The skeleton forms the framework of the body giving shape to the body and protecting vital organs.**

a. Describe bone formation.
b. What is the fate of cells involved in bone formation?
c. Describe the different parts of the thorax.
d. What is its function?
e. What is dense connective tissue?
f. How is it related to the skeleton?

6. **The nervous system consists of many parts that work together to coordinate body functions.**

a. Describe the structure of the neuron.
b. What are neuroglia cells?
c. The Spinal Cord is part of the Central Nervous System (CNS). Describe the spinal cord.
d. Peripheral Nervous System (PNS) is composed of nerves outside the CNS. Name the different parts of PNS.
e. Briefly describe the Sympathetic Nervous system.

END OF EXAMINATION.

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

2003 ACADEMIC YEAR FIRST SEMESTER
FINAL EXAMINATIONS

COURSE AGA 311: PRINCIPLES OF ANIMAL NUTRITION

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

i.   **Answer question 1 and any other five (5) questions.**

ii.   **All questions carry equal marks**

Q1.   Write briefly on the following:
  i.   Methods of Nitrogen excretion in animals.
  ii.   Biologically active compounds derived from cholesterol.
  iii. Antinutritional factors in legume seeds.
  iv.   General functions of microminerals.

Q2.   Given the carbohydrates lactose, sucrose, cellulose, glycogen, and starch write on the following:
  i.   Monosaccharide units that each carbohydrate is made up of,
  ii.   Nutritional source of each carbohydrate,
  iii. Enzymes that digest each carbohydrate in the small intestine.

Q3.   ATP (Adenosine Triphosphate) is the energy currency of the cell. Briefly outline ATP production in relation to the following metabolic pathways:
        i.   Beta-Oxidation of fatty acids.
        ii.   TCA (Tricarboxylic Acid Cycle).

Q4.   There are twenty standard amino acids found in protein.
  i.   What is meant by (a) Essential amino acids and (b) Non-essential amino acids? List the amino acids in each of these categories.
  ii.   Discuss Protein digestion in non-ruminants.

Q5. Discuss the relationship between calcium, phosphorus and vitamin D in the animal body.

Q6. Give three deficiency symptoms and two sources of the following:
  i. any fat soluble vitamin and,
  ii. any three water soluble vitamins.
  iii. What are the biologically active forms of each of the vitamins you have selected?

Q7. i. With the aid of a diagram explain the utilization of food energy, indicating the losses in the process of utilization.
  ii. Define and discuss the Biological Value of Proteins

Q8. i. Ruminants can utilize fiber that non-ruminants cannot utilize. Since mammals lack the enzymes for fiber digestion, explain in detail how fiber utilization is achieved to meet energy requirements in ruminants.
  ii. Write briefly on NPN (Non-Protein Nitrogen) utilization in ruminants.

END OF EXAMINATION

COURSE: AGA 351   ANIMAL SCIENCE FOR ENGINEERS

TIME ALLOWED: THREE (3) HOURS

INSTRUCTION TO CANDIDATES:
Attempt all questions.

Q 1.   (a) The guinea fowl is one species that seems to be gaining popularity as a domestic bird. Briefly discuss some of the attributes of the species that are likely to discourage rapid growth in ownership and retard increases in populations.
(10 Marks)

(b) A goat can be said to have advantages over cattle in as far as survival and resource requirements are concerned. Give an explanation in support of this trend of thought.
(10 Marks)

Q2.   (a)   Describe how temperature, humidity, resting state of an egg and ventilation can affect the development of an embryo in an incubating chicken egg.
(10 Marks)

(b)   Discuss de-beaking, dubbing, toe-clipping and forced-moulting as practised in poultry production.
(10 Marks)

Q3.   Discuss the main activities carried out in caring for a litter of piglets from farrowing to weaning.
(20 Marks)

Q4.   (a) Identify and briefly describe the main elements considered in evaluating semen.
(10 Marks)

(b) Describe oestrus and the reproductive cycle of a cow.
(10 Marks)

Q5.   (a) Describe dairy calf feeding to weaning age.
(10 Marks)

(b) Describe signs of approaching parturition in a cow.
(10 Marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST SEMESTER EXAMINATIONS – AUGUST 2003
AGA 511 – TECHNIQUES IN ANIMAL SCIENCE

TIME: **3 HOURS**

INSTRUCTIONS: **ANSWER ALL QUESTIONS (ANSWER EACH QUESTION IN A SEPARATE BOOKLET)**

SECTION 1: Production Management and Research Techniques

1.   a.   What physical and chemical changes can take place in a feed sample stored for analysis at a later date from the time of collection? How can these changes be avoided so that the nutritional quality of the sample is maintained as a representation of the quality of the original batch of feed?

   b.   Although Feeding Standard Tables are regarded as indispensable guides for meeting the nutritive requirements of animals, they have limitations. Write on any four (4) factors that are not considered in setting the Standards?

   c.   What special considerations should be made in the application of feeding standards for growth.

2.   The digestibility of ruminant feeds affects the dry matter intake (DMI) of such forages. However, it is the DMI that determines animal performance.

   a)   Discuss the field and laboratory methods that are available to researchers for use in estimating the digestibility of ruminant feeds; and

   b)   How are the above methods related to the Peter van Soest Method?

SECTION 2: Blood Collection and Analysis

3.   a.   Differentiate between plasma and serum.

   b.   Why is blood the most examined tissue in animals?

   c.   Describe two (2) blood collection methods used in cattle.

   d.   Describe two (2) blood analyses most commonly done.

SECTION 3: Experimental Design and Data Analysis

4.   a)   Discuss the Principles of Experimental Design

b) It has been reported in literature that the type of litter on which broiler chickens are reared on has a great effect on the chickens' growth rate A fifth year student in Animal Science Department wishes to conduct an experiment to study the effect of type of floor litter on the growth rate of broiler chickens. Day old broiler chickens were reared for six weeks on the following types of floor:

   ❑   Bare concrete floor with no litter (control)
   ❑   Concrete floor covered with wood shavings
   ❑   Concrete floor covered with dry grass, that is, hay.
   ❑   Concrete floor covered with a black plastic sheet

c) Suggest the type of design that would be appropriate for this type of experiment **and** Give the outline of the ANOVA showing **sources of variation and** Degrees of Freedom. Assume he replicated the experiment eight times.

d) What is the null hypothesis for this experiment and what kind of Mean Comparisons would you suggest to be done to test the effect of floor litter on weight gain in broiler chickens?

SECTION 4: Animal Draft Power

5.   a)   The use of female animals may be considered the most efficient way of utilizing animal resources for draft purposes. Briefly discuss the advantages of female animals over oxen.

b)   Briefly discuss the utilization pattern of two (2) energy metabolites (Free fatty acids, Glucose) by muscles during work lasting for five (5) hours.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
UNIVERSITY FIRST SEMESTER EXAMINATIONS – AUGUST 2003
AGA 521 – APPLIED ANIMAL REPRODUCTION

TIME: 3 HOURS

INSTRUCTIONS: **ANSWER THREE (3) FROM SECTION A AND TWO (2) FROM SECTION B IN SEPARATE ANSWER SHEETS**

SECTION A

1. Give a possible environmental-neural-endocrine interaction for the following situations. Be as complete as possible in listing all steps and show if the effect is positive or negative (include increases or degreases)

    a. A mare is in seasonal anestrus. Show a feasible pathway of events that lead to cycling. Follow to complete expression of estrus and ovulation.

    b. A sow is in lactational anestrus. Show a possible interaction that leads to lactation, but lack of cycling.

2. a. Most cows do not return to estrus until 45+ days post-partum. This seems to be a "built-in" factor for successful gestation. What are the uterine changes taking place during this post-partum period?

    b. What factors other than uterine may delay the first post-partum estrus longer than 45-60 days in cattle?

3. Give a basic physiological explanation for each of the following. Only one short explanation is needed, but be complete by following the events to completion; such as, lack of ovulation was due to a lack of LH secretion by the anterior pituitary gland. It is important to demonstrate your depth of knowledge of endocrine, neural and/or anatomical function in each case.

    a. A ewe did not show heat with the first ovulation at the start of the breeding season.

    b. A cow with a double cervix did not conceive when artificially inseminated but did when naturally mated (Give the most probable reason).

    c. With standard management practices sows that ovulate during lactation are selected against.

d.   Ovariectomy (removal of the ovaries) during the latter half of pregnancy did not cause abortion in the mare, but did in the sow.

e.   A sow aborted following pregnancy (she had only three fetuses)

4.   For each of the phenomena listed, give the following information:
        i)   physiological status of the animal (e.g. estrual, metestrus I or II, pregnant, etc.).

        ii)   factors involved (e.g. hormones, anatomical structures, etc.)

        iii)   pathways involved (e.g. if the result involves two factors, show how).

a.   A blood sample from a cow was analyzed for hormone effect levels and the following was found:

Below Dominance	Dominant
LH	FSH
Estrogen	$PGF_{2\alpha}$
Progesterone	

b.   A blood sample from a cow showed LH to be the only really dominant hormone.

c.   A cow was seen bleeding several days following estrus

SECTION B

5.   Poultry production is big business in Zambia. Commercial breeders use Artificial Insemination to produce the large numbers of day old chicks sold to farmers.
        a. Describe semen collection from a cock.

        b. How is this semen processed?

        c. What is the dosage for inseminating chickens?

        d. When and how is insemination done?

        e. How often can you inseminate turkeys and why?

6. Stress is manifested in many ways in reducing fertility.

   a. Define stress.

   b. How does heat stress reduce cattle fertility and how is this stress mediated?

   c. What management measures can you take to reduce effects of heat stress?

   d. Differentiate between fertility, sterility and fecundity.

   e. Describe three anatomical causes of infertility and their effects.

7. Artificial Insemination, is the most notable tool that has caused genetic improvement in livestock world-wide. Although it dates back to the 14th Century, there are challenging problems in evaluation, processing and increasing fertility.

   a. What are considered as appropriate constituents of an extender and why?

   b. What causes reduction of fertility in frozen semen? What steps are taken to improve it?

   c. How do you evaluate semen fertility *in situ*?

   d. Determine the number of frozen semen inseminations you will get from bull semen with the following characteristics:

Volume	10 ml
Concentration	850 million sperm per ml of semen
Motility	70%
Normal Cells	90%

   e. How often can you collect semen from a bull, ~~dates back to the 14th Century dates back to the 14th Century?~~

END OF EXAMINATION

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THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

END OF FIRST SEMESTER EXAMINATIONS – AUGUST, 2003

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   Formulate a ration for beef cattle, with the help of the Pearson Square, containing 13% DCP and 70% TDN which must include 15% Natural Grass/Stylo Hay, 10% Maize Bran, 5% Sugarcane Molasses, 3% Soyabean Straw and 2% slack space for mineral supplement, on dry matter basis. The table below may be used to answer the question:

| FEED | Feed analyses (on dry matter basis, i.e. moisture free) | | | | |
	DM%	DCP%	TDN%	Ca	P
Natural grass/Stylo	92	22.5	58	1.90	0.20
Maize bran	90	12.5	70	0.07	1.62
Molasses	75	-	85	1.19	0.11
Soyabean straw	85	25.0	65	0.69	0.06

Other feeds available are:-

Maize meal	89	10.0	88	0.03	0.31
Groundnut meal	95	55.0	90	0.18	3.62
Groundnut haulms	87	2.0	62	0.07	0.17
Lucerne hay	90	85.0	60	0.27	0.03

(40 marks)

Q. 2   In poultry and pigs, the requirement for protein is in fact the requirement for amino acids in the proper proportions. Discuss the meaning of this statement with respect to the feed ingredients available and used in ration formulation in Zambia.

(20 marks)

Q. 3   If a dairy cow in mid-lactation weighing 480 kg eats 20 kg per day fresh Rhodes Grass (*Chloris guyana*)/Silver Leaf (*Desmodium uncinatum*) mixture and produces 20 kg/day milk containing 3.8% butterfat and 9.0% solids-not-fat.

a)   How much concentrate mixture (of 40% Corn and Cob Meal, 20% Fuzzy Cotton, 20% Soyabean Cake and 20% Fish Meal) will she need to eat to provide sufficient energy to maintain her body weight?

The following may be used to answer the question: -

	DM(g/kg)	ME(MJ/kg DM)
Rhodes Grass/Siverleaf	300	9.0
Corn and Cob Meal	960	12.5
Fuzzy Cotton	920	10.0
Soyabean Meal	930	9.5
Fish Meal	950	13.0

b)   Calculate the rations that meet both dry matter appetite and energy allowances using the rapid formulation of forage and compound feed rations, given that the forage and concentrate in a) above and the energy concentration of the ration (M/D).

c)   If the 480kg dairy cow in a) above was in early lactation and was actually losing 0.5kg per day, how much concentrate mixture will she need to eat to maintain her body weight?

d)   If the 480kg dairy cow in a) above was in late lactation and was actually gaining 0.5kg per day, how much concentrate mixture will she need to eat to maintain her body weight?

(20 marks)

Q. 4   Write notes on the following: -

a)   The causes of Acidosis in dairy cattle? As a nutritionist, discuss how you would your knowledge of ruminant digestion to prevent the occurrence of acidosis in dairy cattle on different types of feeds.

b)   Cyanogenetic glycosides and glucosinolates;

c)   The advantages and disadvantages of the fore-stomach fermentation as opposed to hind gut fermentation.

d)   Causes of acatonaemia and discuss the methods of prevention and treatment in order to avoid deaths in affected cattle.

(20 Marks)

Q. 5   Answer the following:

a)   How much is a Boran steer weighing 345kg expected to grow if it is fed on daily ration consisting of the following feed-stuffs: -

        9.5 kg Maize Silage (300 g/kg DM, 8.6 MJ ME/kg DM)
        7.5 kg Maize Meal (850 g/kg DM, 12.5 MJ ME/kg DM)
        2.5 kg Cane Molasses (270 g/kg DM, 13.0 MJ ME/kg DM)

b)   Calculate the True Biological value of a protein supplement from the data given below:

➤   Dry matter feed consumed daily (grams)   = 8.50
➤   Percent nitrogen in the feed, dry matter basis (dmb)   = 2.196
➤   Daily urinary output (mls) = 20.50, containing
      -    0.00486g total nitrogen per ml, and
      -    0.0025g endogenous nitrogen per ml.
➤   Daily dry matter faecal output (grams)   = 6.40, containing
      -    3.82 mg total nitrogen per gram, and
      -    2,75 mg metabolic faecal nitrogen per gram, dmb.

(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. $EVI = 0.0386 \, BF + 0.0205 \, SNF - 0.236$

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

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

vii. $MI = \dfrac{EVI \times 1.05}{0.62}$

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

END OF EXAMINATION

AGC 411: FIELD CROP PRODUCTION

TIME ALLOWED: THREE (3) HOURS
INTRUCTIONS: ANSWER ALL QUESTIONS

1.   Leguminous crops contribute significantly to the food security and industrial development of any nation. Discuss this statement giving relevant examples where appropriate.

(20 Marks)

2.   (a)   Late planting predisposes certain crops to attack by disease(s). Name the vulnerable crops and give symptoms of the various disorders.

(14 Marks)

      (b)   For each crop given in (a), explain the relevant control measures which are undertaken.

(6 Marks)

3.   Beginning from the selection of the planting material, prepare a compendium of information which would guide a farmer to plant cassava. Your answer must include the various options which may arise that require a farmer to make choices.

(30 Marks)

4.   What considerations would you take into account when deciding to harvest the following crops and how would you harvest them?

      (a)   Cotton   (10 Marks)
      (b)   Groundnuts   (10 Marks)

5.   Describe the control of water during the growing season of rice. How is this achieved.

(10 Marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

DEPARTMENT OF CROP SCIENCE

FIRST SEMESTER EXAMINATIONS

AGC 431 – AGRICULTURAL ENTOMOLOGY

Instructions: Answer all questions. All questions carry equal Marks.
Time: 2½ hours

Q1. Define cultural control. Discuss in detail crop rotation as a method of cultural control. **(20 marks)**

Q2. Describe the general characters and economic importance of the order ISOPTERA. **(20 marks)**

Q3. Discuss the variations in the life history of insects. **(20 marks)**

Q4. Define integrated control and outline the principal features of pest management. **(20 marks)**

Q5. Outline the causes of insect outbreaks and discuss mechanical control as a means of reducing insect populations. **(20 marks)**

End of Exam

AGC 511: ASPECTS OF CROP PRODUCTION

TIME ALLOWED: THREE HOURS
INTRUCTIONS:
(i)   ANSWER ALL QUESTIONS
(ii)   MARKS AS INDICATED

Q1.   (a)   Explain the significance of light extinction Coefficient (K-value) in crop production.   (5)

      (b)   Explain the reasons for the discrepancies in crop yields between the temperate and tropical countries.   (10)

Q2.   Water stress has serious negative effects on crop yields.

      (a)   Explain the various effects of water stress on crop productivity.   (12)
      (b)   Suggest ways in which this type of stress can be mitigated against to ensure high crop productivity.   (13)

Q3.   Using your knowledge of agronomy, explain implications and the type of advice you would give to small-scale farmers who are not likely to adhere to recommended plant populations.   (20)

Q4.   Calculate the photosynthetic efficiency (ε) for maize based on the following assumptions:

      (i)   Total yield at 13% moisture = 19,500 kg/ha
      (ii)   Energy received/ha during a 110 day growing season
             = 2,500,340,000 MJ.   (20)

Q5.   Write brief notes on the significance of the following in crop production.

      (a)   Fractional interception (f)   (4)
      (b)   Leaf Area Index (LAI)   (4)
      (c)   Harvest Index (HI)   (4)
      (d)   Nutrient stress   (4)
      (e)   Planting dates   (4)

GOOD LUCKY

END OF EXAM

AGC 531: PRINCIPLES OF WEED SCIENCE

TIME ALLOWED: THREE (3) HOURS
INSTRUCTIONS: ANSWER QUESTION 1 AS IT IS COMPULSORY AND 4
OTHER QUESTIONS. POINTS FOR EACH QUESTION
ARE INDICATED

Q1. **40 Points**

(a) Define a weed from an ecologists view point, an enthusiast point of view, ending one that an agronomist uses giving the premise on which the later makes their definition.

(b) Fill in the following table

Family	Weed Common Name	Scientific Name
(i) Amaranthaceae		
(ii) Asteraceae		
(iii) Commelinaceae		
(iv) Convolvulaceae		
(v) Euphorbiaceae		
(vi) Malvaceae		
(vii) Portulacaceae		
(viii) Pontedenaceae		
(ix) Poaceae		
(x) Sctophulariaceae		

(c) Define the following terms:

(i) Facultative parasite
(ii) Functional allelopathy
(iii) Noxiocius weed
(iv) Plant quarantine
(v) Photodecomposition
(vi) Surfactant
(vii) Period threshold
(viii) Solarization
(ix) Apoplastic absorption
(x) Water dispersible granules

(d) Discuss weed eradication, weed control and weed management.

Q.2   15 Points

   (a) $W = Wm (1 + a Nw)^b$
          Which law does this equation represent and what is its importance on weed science?

   (b)   What are the various losses attributed to weeds to the farming community?

Q.3   15 Points

   (a)   Discuss the important weed crop interactions relevant to farming.
   (b)   Give the distinguishing features of the following herbicide groups with an example of a herbicide by common name.

          (i)   Aliphatics
          (ii)   Bipyridyliums
          (iii)   Phenoxys
          (iv)   Triazines

Q.4   15 Points

   (a)   Enumerate the various methods in which weeds may be classified.
   (b)   Discuss the "Self-thinning law".

Q.5   15 points

   (a)   Discuss the fate of herbicides in the soil.
   (b)   How would you calculate the economic injury level for weeds?

Q.6   15 Points

Discuss the various aspects of

   (a)   Culture weed control
   (b)   Biological weed control
   (c)   Preventive weed control

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
FIRST SEMESTER EXAMINATIONS – AUGUST 2003

AGE 411: INTRODUCTORY TO AGRIBUSINESS MANAGEMENT

TIME ALLOWED: THREE (3) HOURS

INSTRUCTIONS: ANSWER **FIVE** QUESTIONS ONLY (i.e. ANSWER QUESTION **ONE** WHICH IS **COMPULSORY** AND THEN SELECT **FOUR** OTHERS FROM THE REMAINING QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

1.   A Company has a cash balance of K300,000 a the beginning of June and you are required to prepare a cash budget for June, July, August, having regard to the following information.

   1.   Salaries are paid in the current month.
   2.   Creditors give one month credit
   3.   Fixed costs are paid on monthly basis in arrears and include a charge of depreciation K50,000 per month.
   4.   Credit sales are settled as follow 40% in the month of sale, 45% in the next month and 12% in the following month. The balance represents bad debts following month. The balance represents bad debts

Month	Cash Sales (K'000)	Credit Sales (K'000)	Purchases (K'000)	Salaries (K'000)	Fixed Costs (K'000)
April		740	5,522	90	300
May		820	612	90	300
June	200	800	600	95	300
July	220	900	690	95	320
August	250	1,000	750	100	320

Required:

Prepare a Cash budget:

2.   Many studies indicate that Agribusinesses in Zambia are not adequately financed. However, a proper analysis of the financing of agribusinesses reveals that it is lack of knowledge about the sources (debt versus equity) of finance rather than the finance itself that is the problem.

   Required:

   Discuss the statement agreeing or disagreeing with it and also highlight the possible ideal sources of finance for agribusiness in Zambia.

3. "To succeed in business, it is more important to know what competition you are up against than to know what your customer want"

Required

Discuss the proposition

4. Total quality management is a strategic issue. It is one of the performance characteristics that any agribusiness manager/entrepreneur may choose to emphasise if his/her business is to survive in this dynamic business environment.

Required

Discuss and in the process highlight ways by which high quality might lead to greater profits for a Company.

5. Planning is necessary for any business to succeed, yet often enterprises do not devote enough time and energy. Recent research suggests that one of the major reasons for business failure is poor management, which is attributed to failure to plan effectively.

Required

Evaluate the statement and explain the role and importance of a business plan.

6. Write brief notes on the following:

  (a) Five personal factors of the entrepreneur that may be considered important in starting a new business
  (b) Marketing mix
  (c) Steps of the business strategic planning process
  (d) Challenges in management of agribusiness products

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
UNIVERSITY FIRST SEMESTER EXAMINATIONS- AUGUST 2003

AGE 421 PRODUCTION ECONOMICS

TIME: 3 HOURS   **MARKS: 100**

INSTRUCTIONS:
ANSWER NUMBER ONE (1) AND ANY OTHER FOUR (4) QUESTIONS.
EACH QUESTION CARRIES EQUAL MARKS.

1.   In Zambia, maize is a very important crop. Research has established that up to a certain point, there is a positive relationship between yield and nitrogen fertilizer.

   Given the following production function:

   $$Y = 70 + 2X - 0.02X^2$$

   a)   Determine and interpret the marginal and average physical product

   b)   Estimate and interpret the elasticity of production

   c)   Find the output maximizing level of input use

   d)   Some people argue that there is no need to expand the total planted area of maize. In order to feed the rising population, farmers should just be encouraged to apply increasing quantities of fertilizer on existing cultivated areas.
   Using illustrations, discuss this position.

2.   Let "pure competition" be used to describe a situation in which there are many producers and a homogeneous product.

   a)   In the short run, how does a producer in a perfectly competitive industry maximize his profit?

   b)   Under what conditions will he produce at a loss?

   c)   Under what conditions will he stop producing temporarily?

3.   a)   Minimum unit cost of a product is not always an indicator of maximum net returns. Discuss and illustrate.

   b) $Y = 10X - X^2$. Find the exact elasticities of production when $X = 2, 4$ and 5.

c) How much will $1,000 deposited in a savings account earning a compound annual interest rate of 6% be worth at the end of the following number of years?

    i)   3 years

    ii)   5 years

    iii)   10 years

4. The production function is $Y = 0.5\ X^{\square}$.

a) Prove that $\square$ is the elasticity of production.

b) Has this function a point of inflection?

c) If $\square = \frac{1}{2}$, what are the MPP and APP when X = 4, 9, 16 and 25.

5. a) Your mother is planning to retire this year and start her own farm. Her firm has offered her a lump sum retirement payment of $50,000 or a $6,000 life time annuity – whichever she chooses. Your mother is in reasonably good health and expects to live for at least 15 more years. Which option should she choose, assuming that an 8% interest rate is appropriate to evaluate the annuity?

b) Distinguish between the term economies of size and the term economies of scale.

6. a) Briefly define and discuss the following terms.

    i)   Production possibility curve

    ii)   Substitution effect

    iii)   Discounting

    iv)   Net Present value

b) Consider the production function

$$Y = X_1^{\frac{1}{2}}\ X_2^{\frac{1}{4}},\ P_{X1} = \$4,\ P_{X2} = \$2.$$

Find the least cost combinations of X_1 and X_2 to produce 8 units of Y.

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENECS

DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION EDUCATION

INTERANTIONAL AGRICULTURAL TRADE (AGE 531)
FINAL EXAMINATION

Time: **Three Hours**

Instructions: **The examination paper has three sections. Please follow the instructions in each section.**

SECTION I

Instructions: **Question number 1 is compulsory**

1. Adam Smith stated that free trade offers advantages of specialization and economies of size, which in turn lower costs and raise living standards. Briefly discuss and illustrate the following:

   a) The importance of comparative advantage (10 marks)
   b) Terms of trade (5 marks)
   c) Cooking oil is derived from oil seeds, such as sunflower, soybeans, and groundnuts. Despite the suitable climate and soil, most of the cooking oil is imported. The Government is not happy with this situation and is therefore, encouraging small and emergent farmers to expand production of oil seed crops. A recent UNZA study estimated the Domestic Resource Costs (DRC) and the net profits of oil seed crops:

Type of Farmer/Crop	DRC	Net Profit/Ha ($/Ha)	Variable Cost/Ha ($/Ha)	GM/VC Ratio
Small scale Farmers:				
Sunflower	0.32	32.25	33.64	0.96
Soybeans	0.72	7.31	106.30	0.07
Groundnuts	0.50	67.98	110.48	0.62
Emergent Farmers:				
Sunflower	0.46	25.47	53.21	0.55
Soybeans	0.65	23.71	124.10	0.22
Groundnuts	0.53	72.26	147.14	0.52

   i. Is the Government justified in promoting all oil seeds? (5 marks)
   ii. Using the above table, explain why farmers have not significantly increased production of oil seeds. (10 marks)
   iii. Estimate and interpret the competitiveness coefficients of oil seeds. (10 **marks**)

SECTION II

Instructions: answer any two questions from section II

2. Many politicians are disappointed with the prevailing maize price. Given that the c.i.f. of maize is $0.22 per kg, the exchange rate is K5000 per dollar ($), the ad-valorem import tax on maize is zero, and the domestic price of maize is K600 per kg.

    a) Is maize production protected in Zambia? (5 marks)
    b) Discuss the importance and proxies of border price. (5 marks)
    c) Discuss the consequences of exchange rate distortion. (5 marks)

3. Discuss the following:
    d) The estimation and interpretation of Effective Protection Coefficient and the Effective Protection Rate (10 marks)
    e) The impacts of dumping in Zambia (3 marks)
    f) The terms of trade (2 marks)

4. Many decision makers are urging the government to restrict trade.
    a) Discuss the arguments for trade barriers (5 marks)
    b) Discuss the major conclusions and weaknesses of the Hecksher-Ohlin synthesis (10 marks)

SECTION III

Instructions: Answer any two questions from section III

5. Discuss the following:
    a) The different types of economic integration. (10 marks)
    b) The acceptable agricultural distortions under free trade arrangements. (3 marks)
    c) The non-tariff barriers that are used to circumvent free trade. (2 marks)

6. Major trade enhancing institutions extend help to Zambia. Discuss the characteristics and nature of support of the major trade enhancing institutions. (15 marks)

7. The IMF and the World Bank are usually blamed for the current economic problems in Zambia. Discuss the validity of this statement. (15 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL ACIENCES
FIRST SEMESTER FINAL EXAMINATION - AUGUST 2003

AGE 541: PROJECT PLANNING AND APPRAISAL

TIME: THREE HOURS

INSTRUCTIONS:
    i)   ANSWER ALL QUESTIONS
    ii)   LEAVE DISCOUNT TABLES IN THE EXAMINATION HALL

TOTAL MARKS: 100

Q1.   a) What is a project cycle? Depict graphically the various stages of the project cycle. (5 marks)

    b) Project preparation and analysis has six main aspects that are interlinked. Discuss briefly the technical and commercial aspects of project preparation and analysis. (5 marks)

    c) J. Price Gittinger states that when a project analysis has failed to anticipate the outcome of a project investment, a common reason appears to have been simply poor preparation of the analysis. Discuss the common reasons for poor project analysis. (5 marks)

    d) The process of project analysis is highly iterative; that is, the analyst must continuously go back and adjust earlier decisions in the light of what is learned from later analysis. However, in general there are steps that an analyst has to follow. Outline the main steps in project analysis. (5 marks)

Q2.   A coffee processing equipment is to be imported into the country for a coffee project in Mkushi. The c.i.f. price for the processing equipment is US$80,000; the import levy is 5% of the c.i.f. price; the handling and clearing charges are 2% of the c.i.f. price and the transportation of the equipment to the project site is K2 million. The official exchange rate (OER) is K5, 000 to 1US Dollar and also a foreign exchange premium of 20% has been estimated.

    a) Calculate the financial import parity price at project boundary. (5 marks)
    b) Calculate the economic import parity value using the conversion factor approach. (5 marks)
    c) Calculate the economic import parity value using the shadow exchange rate approach. (5marks)
    d) Define traded and non-traded items in economic analysis. (5 marks)

Q3. The following investment outlays, operation and maintenance costs (cash outflows) as well as gross benefits (cash inflows) are given for projects A and B. All value figures are in Zambian Kwacha.

Project A

Year	Investment Outlay	Cash Outflows	Cash Inflows
0	300,000,000	0	0
1	0	9,000,000	119,000,000
2	0	10,500,000	120,500,000
3	0	10,500,000	120,500,000
4	0	10,500,000	120,500,000
5	0	15,000,000	125,000,000

Project B

Year	Investment Outlay	Cash Outflows	Cash Inflows
0	300,000,000	0	0
1	0	13,000,000	123,000,000
2	0	14,000,000	134,000,000
3	0	15,000,000	145,000,000
4	0	40,000,000	140,000,000
5	0	40,000,000	140,000,000

a) Given an opportunity cost of capital of 25%; calculate the Net Present Value (NPV) for both projects A and B. (8marks)

b) Compute the internal rate of return (IRR) for both projects A and B. (8 marks)

c) If projects A and B are mutually exclusive and on the basis of the results you obtain either in a) or b) above, which project would you rank first to be chosen between the two projects? Explain why? (4 marks)

Q4. a) What advantages do discounted measures of project worth have over undiscounted measures of project worth? (5 marks)

b) Outline briefly the main steps in economic analysis for adjusting financial prices to economic values. (5marks)

c) Discuss the concept of opportunity cost in economic analysis. (5 marks)

e) There are several approaches to estimating the domestic resource cost. Describe one such approach familiar to you and explain why it is important to estimate the domestic resource cost and for which type of projects. (5 marks)

Q5. Write short notes on the following:
a) Time Value of Money (5 marks)
b) Valuing land in economic analysis (5 marks)
c) Valuing labour in economic analysis (5 marks)
d) Pricing intermediate goods (5 marks)

END OF EXAMINATION

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

FIRST SEMESTER EXAMINATIONS-AUGUST 2003
GENERAL MICROBIOLOGY (AGF211) – THEORY PAPER

TIME: THREE HOURS
INSTRUCTIONS: ANSWER <u>ANY FIVE</u> QUESTIONS. Answers may be enhanced by producing relevant tables, graphs and diagrams. All questions carry equal marks.

1.

   (a) List five (5) differences between prokaryotes and eukaryotes

   (b) Bacteria have characteristic shapes and grouping. The main groups of the cocci are ....

   © What are the essential structures of bacteria and their functions?

   (d) The majority of bacteria are described as facultative anaerobes, certain other species are described as strict or obligate aerobes whereas others are known as strict or obligate anaerobes. Define the three categories.

2.

   (a) What are the criteria used for the taxonomy of bacteria? Which one of these generally serves as a preliminary criterion?

   (b) What are the six main reactions in the glycolytic pathway? Show the different enzymes and cofactors if any for each reaction.

   © List the four metabolic pathways of glucose catabolism

3.

   (a) Viruses cannot be grown on agar media or in broth medium unless living cells are present, no matter how much these media may be enriched with special growth factors. Why?

   (b) Name the three types of cultures used to grow viruses and how they are produced.

(c) Define virion. State five (5) differences between virions and prions.

(d) List five antiviral agents and how they inhibit viruses.

4.

Changes in the genome of the bacteria can occur by two processes: mutation and recombination. Define the two processes and write brief notes on the different types within each process.

5.
(a) Give an outline of the cell structure of fungi.

(b) Two phases characterize the growth cycle of most fungi, which are these phases? Write brief notes on each phase.

6. Overreaction of the immune system is known as hypersensitivity. Discuss the reaction types as classified according to Coombs and Gell.

7.

(a) What are the characteristics of antibody-antigen reactions?

(b) In majority of cases when an antigen is introduced in the body it takes a few days for the antibodies to appear. Explain.

(c) List the routes of entry of an antigen and the mechanisms of defense in any one of them.

8.

(a) Sulphonamides are structural analogues of and act in competition with para-amino benzoic acid. Discuss.

(b) In contrast to the antibacterial drugs, the number of antifungals suitable for treatment of infections by fungi is very limited. Explain.

_____END OF EXAMINATION_____

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SEMESTER I EXAMINATIONS – AUGUST 2003
Methods in Food Analysis Practical AGF 311

TIME: 3 HOURS

In this examination, you are provided with a water sample whose calcium and total hardness you will be required to determine. You are also provided with the necessary reagents to enable you do the task at hand. Remember that EDTA reacts with divalent metal ions at pH 10 in a 1:1 fashion. Remember to write out a very simple report in your own words to include the title, very brief introduction (2 sentences maximum), data in tabular format, a sample calculation (only one for each section) and conclusion/discussion.

Preparation of a Standard EDTA solution:

Weigh accurately about 0.9 g of the disodium EDTA. Dissolve in about 100 ml of distilled water in a 250 ml beaker. Cool to room temperature. Transfer to a 250 ml volumetric flask and make up to the mark. Calculate the molarity of this solution.

Calcium Hardness

Pipette 100 ml of the water sample into a 250 ml conical flask, add 1 ml of 4 M NaOH and a spatulaful of murexide indicator. Wait for 3 minutes and then titrate with EDTA over a white background until a violet color appears. Repeat three times. Calculate the average calcium hardness as ppm $CaCO_3$.

Total Hardness

Pipette 100 ml of tap water into a 250 ml conical flask. Add 2 ml of ammonia buffer pH 10 and 2 drops of freshly prepared 1 % NaS solution. After 1 minute add a tip of a spatula Erio T indicator and titrate with the EDTA solution until the last traces of red has disappeared from the solution. Repeat three times. Calculate the total hardness as ppm $CaCO_3$.

THE UNIVERSITY OF ZAMBIA
UNIVERSITY SEMESTER I EXAMINATIONS – AUGUST 2003
Methods in Food Analysis Practical AGF 311

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

FIRST SEMESTER EXAMINATIONS-AUGUST 2003

AGF 341 – TECHNICAL THERMODYNAMICS

INSTRUCTIONS

Open book exam. Only notes and handouts are allowed. No solved exercises allowed.

Note: In all problems, set up equations and show all units

==

QUESTION 1

Is temperature fluctuation in the range of 0 to -18°C more damaging to frozen food than temperature fluctuation in the range colder than -18°C? Why.

QUESTION 2

Lord Kelvin stated that "No process is possible whose sole result is the extraction of heat from a single reservoir and the performance of an equivalent amount of work." What does this law tell us about the maximum possible efficiency of converting fuel energy into electricity?

QUESTION 3

A simple saturated compression refrigeration system using R12 (Text Table A.6.1- Introduction to Food Engineering Singh) as the refrigerant. Evaporator pressure = 139.53 kPa; condenser pressure = 805.41 kPa (pressures are absolute).

a. Find the evaporator and condenser temperatures

b. Label the corresponding parts of the refrigeration system, the temperatures, and the H-values in the pressure-enthalpy diagram below.

c. From the appropriate charts and tables, find

H1,

H2, and

H3.

d. Calculate the C.O.P. of this system.
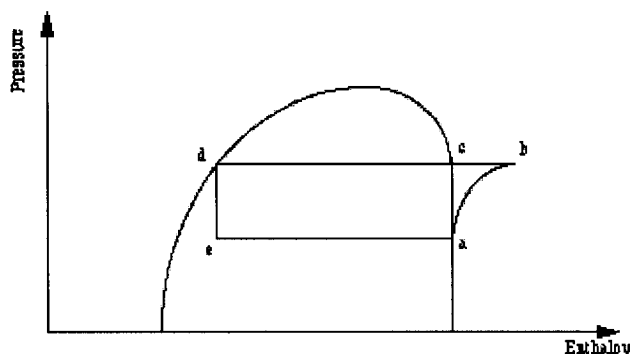
QUESTION 4

Fresh strawberries with water content of 88% (by mass) at 30°C are stored in 0.8kg boxes made of nylon [C_p(average specific heat) =1.7kJ/kg°c]. Each box contains 23kg of strawberries and the strawberries are to be cooled to an average temperature of 4°C at a rate of 60 boxes per hour. Taking the average specific heat of the strawberries to be C_p = 3.89kJ/kg.°C and the average heat of respiration to be 210 mW/kg,, determine the rate of heat removal from the strawberries and their boxes, in kJ/h. What would be the percent error involved if the strawberries boxes were ignored in the calculations?

QUESTION 5

Water at standard conditions (ρ = 1000 kg/m3; μ= 1535 x 10-6 Pa s) is being pumped at a mean velocity of 0.15 m/s from constant-level tank A to the top of tank B as shown. The pipe diameter is 0.02 m, there are 100 m of straight pipe. Height Z_1 = 3 m; height Z_2 .= 18 m Neglecting any heat interaction with the surroundings and frictional heating effects, determine the power input to the pump .(Note: You may not need all of this information to answer these questions.)
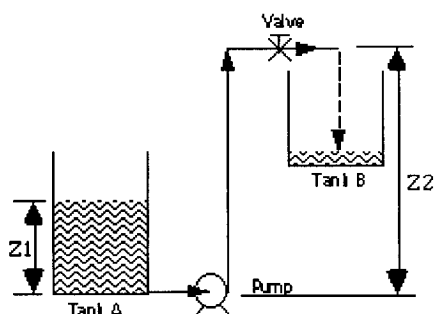
--*End of Exam*---

TABLE A.6.1
Properties of Saturated Liquid and Vapor R-12^a

t (°C)	P (kPa)	Enthalpy (kJ/kg)		Entropy (kJ/kg·K)		Specific volume (L/kg)	
		h_f	h_g	s_f	s_g	v_f	v_g
−60	22.62	146.463	321.236	0.77977	1.61373	0.63689	637.911
−55	29.98	150.808	326.567	0.79990	1.60552	0.64226	491.000
−50	39.15	155.169	328.897	0.81964	1.59810	0.64782	383.105
−45	50.44	159.549	331.223	0.83901	1.59142	0.65355	302.683
−40	64.17	163.948	333.541	0.85805	1.58539	0.65949	241.910
−35	80.71	168.369	335.849	0.87676	1.57996	0.66563	195.398
−30	100.41	172.810	338.143	0.89516	1.57507	0.67200	159.375
−28	109.27	174.593	339.057	0.90244	1.57326	0.67461	147.275
−26	118.72	176.380	339.968	0.90967	1.57152	0.67726	136.284
−24	128.80	178.171	340.876	0.91686	1.56985	0.67996	126.282
−22	139.53	179.965	341.780	0.92400	1.56825	0.68269	117.167
−20	150.93	181.764	342.682	0.93110	1.56671	0.68547	108.847
−18	163.04	183.567	343.580	0.93816	1.56526	0.68829	101.242
−16	175.89	185.374	344.474	0.94518	1.56385	0.69115	94.2788
−14	189.50	187.185	345.365	0.95216	1.56250	0.69407	87.8951
−12	203.90	189.001	346.252	0.95910	1.56121	0.69703	82.0344
−10	219.12	190.822	347.134	0.96601	1.55997	0.70004	76.6461
−9	227.04	191.734	347.574	0.96945	1.55938	0.70157	74.1155
−8	235.19	192.647	348.012	0.97287	1.55897	0.70310	71.6864
−7	243.55	193.562	348.450	0.97629	1.55822	0.70465	69.3543
−6	252.14	194.477	348.886	0.97971	1.55765	0.70622	67.1146
−5	260.96	195.395	349.321	0.98311	1.55710	0.70780	64.9629
−4	270.01	196.313	349.755	0.98650	1.55657	0.70939	62.8952
−3	279.30	197.233	350.187	0.98989	1.55604	0.71099	60.9075
−2	288.82	198.154	350.619	0.99327	1.55552	0.71261	58.9963
−1	298.59	199.076	351.049	0.99664	1.55502	0.71425	57.1579
0	308.61	200.000	351.477	1.00000	1.55452	0.71590	55.3892
1	318.88	200.925	351.905	1.00335	1.55404	0.71756	53.6869
2	329.40	201.852	352.331	1.00670	1.55356	0.71924	52.0181
3	340.19	202.780	352.755	1.01004	1.55310	0.72094	50.4700
4	351.24	203.710	353.179	1.01337	1.55264	0.72265	48.9499
5	363.55	204.642	353.600	1.01670	1.55220	0.72438	47.4853
6	374.14	205.575	354.020	1.02001	1.55176	0.72612	46.0737
7	386.01	206.509	354.439	1.02333	1.55133	0.72788	44.7129
8	398.15	207.445	354.856	1.02663	1.55091	0.72966	43.4006
9	410.58	208.383	355.272	1.02993	1.55050	0.73146	42.1349
10	423.30	209.323	355.686	1.03322	1.55010	0.73326	40.9137
11	436.31	210.264	356.098	1.03650	1.54970	0.73510	39.7352
12	449.62	211.207	356.509	1.03978	1.54931	0.73695	38.5975
13	463.23	212.152	356.918	1.04305	1.54893	0.73882	37.4991
14	477.14	213.099	357.325	1.04632	1.54856	0.74071	36.4382
15	491.37	214.048	357.730	1.04958	1.54819	0.74262	35.4133
16	505.91	214.998	358.134	1.05284	1.54783	0.74455	34.4230
17	520.76	215.951	358.535	1.05609	1.54748	0.74649	33.4658
18	535.94	216.906	358.935	1.05933	1.54713	0.74846	32.5405
19	551.45	217.863	359.333	1.06258	1.54679	0.75045	31.6457
20	567.29	218.821	359.729	1.06581	1.54645	0.75246	30.7802

Source: Stoecker (1988)

TABLE A.6.1 (Continued)

t (°C)	P (kPa)	Enthalpy (kJ/kg)		Entropy (kJ/kg·K)		Specific volume (L/kg)	
		h_f	h_g	s_f	s_g	v_f	v_g
21	583.17	219.783	360.124	1.06904	1.54612	0.75419	29.9429
22	599.98	220.746	360.514	1.07227	1.54579	0.75635	29.1327
23	616.84	221.712	360.904	1.07549	1.54547	0.75863	28.3485
24	634.05	222.680	361.291	1.07871	1.54515	0.76073	27.5894
25	651.62	223.650	361.676	1.08193	1.54484	0.76286	26.8542
26	669.54	224.623	362.059	1.08514	1.54453	0.76501	26.1442
27	687.82	225.598	362.439	1.08835	1.54423	0.76718	25.4524
28	706.47	226.576	362.817	1.09155	1.54393	0.76938	24.7840
29	725.50	227.557	363.193	1.09475	1.54363	0.77161	24.1362
30	744.90	228.540	363.566	1.09795	1.54334	0.77386	23.5082
31	764.68	229.526	363.937	1.10115	1.54305	0.77614	22.8993
32	784.85	230.515	364.305	1.10434	1.54276	0.77845	22.3088
33	805.41	231.506	364.670	1.10753	1.54247	0.78079	21.7359
34	826.36	232.501	365.033	1.11072	1.54219	0.78316	21.1802
35	847.72	233.498	365.392	1.11391	1.54191	0.78556	20.6408
36	869.48	234.499	365.749	1.11710	1.54163	0.78799	20.1173
37	891.64	235.503	366.103	1.12028	1.54135	0.79045	19.6091
38	914.23	236.510	366.454	1.12347	1.54107	0.79294	19.1156
39	937.23	237.521	366.802	1.12665	1.54079	0.79546	18.6362
40	960.65	238.535	367.146	1.12984	1.54051	0.79802	18.1706
41	984.51	239.552	367.487	1.13302	1.54024	0.80062	17.7182
42	1008.8	240.574	367.825	1.13620	1.53996	0.80325	17.2785
43	1033.5	241.598	368.160	1.13938	1.53968	0.80592	16.8511
44	1058.7	242.627	368.491	1.14257	1.53941	0.80863	16.4356
45	1084.3	243.659	368.818	1.14575	1.53913	0.81137	16.0316
46	1110.4	244.696	369.141	1.14894	1.53885	0.81416	15.6386
47	1136.9	245.736	369.461	1.15213	1.53856	0.81698	15.2563
48	1163.9	246.781	369.777	1.15532	1.53828	0.81985	14.8844
49	1191.4	247.830	370.088	1.15851	1.53799	0.82277	14.5221
50	1219.3	248.884	370.396	1.16170	1.53770	0.82573	14.1701
52	1276.6	251.004	370.997	1.16810	1.53712	0.83179	13.4931
54	1335.9	253.144	371.581	1.17451	1.53651	0.83801	12.8509
56	1397.2	255.304	372.145	1.18093	1.53589	0.84451	12.2412
58	1460.5	257.486	372.688	1.18738	1.53524	0.85121	11.6620
60	1525.9	259.690	373.210	1.19384	1.53457	0.85814	11.1113
62	1593.5	261.918	373.707	1.20034	1.53387	0.86534	10.5872
64	1663.2	264.172	374.180	1.20686	1.53313	0.87282	10.0881
66	1735.1	266.452	374.625	1.21342	1.53235	0.88059	9.61234
68	1809.3	268.762	375.042	1.22001	1.53153	0.88870	9.15844
70	1885.8	271.102	375.427	1.22665	1.53066	0.89716	8.72502
75	2087.5	277.100	376.234	1.24347	1.52821	0.92009	7.72258
80	2304.6	283.341	376.777	1.26069	1.52526	0.94612	6.82143
85	2538.0	289.879	376.985	1.27845	1.52164	0.97627	6.00494
90	2788.5	296.788	376.748	1.29691	1.51708	1.01190	5.25759
95	3056.9	304.181	375.887	1.31637	1.51113	1.05531	4.56341
100	3344.1	312.261	374.070	1.33732	1.50296	1.11311	3.90280

Source: Stoecker (1988)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
FOOD SCIENCE AND TECHNOLOGY DEPARTMENT
FIRST SEMESTER FINAL EXAMINATION

COURSE: AGF: 411 – WATER AND FOOD WASTE TREATMENTS

TIME: THREE
<u>INSTRUCTION: ALL QUEATIONS CARRY 2O POINTS</u>
<u>ANSWER ANY FIVE</u>

1. You are given water, which is supposed, to be for drinking it contains the following suspended materials, dissolved organic materials, foul tastes and some pathogenic microorganisms. This water also contains the following minerals iron, manganese ammonium and nitrates. Additionally this water is extremely turbid. Explain how you would make it portable. Mention each treatment method or methods for each undesirable constituent mentioned. Indicate how you would indicate to the would be users of this water that those water is portable. What statutory bodies would you refer to achieve this? (20 Points)

2. (a) Name 4 recovery products of activated sludge. Say something about the significance of each product you have mentioned and its potential for future utilisation. What type of water is normally not used in recovery of products from sludges, (5 Points)?
   (c) What is flocculation? Name the two types of bacteria responsible for flocculation. What causes bulking and what causes pin point flocks. (5 Points)
   (d) Name 5 types of special activated sludges explain briefly how each one functions and explain its significance to the process. (5 Points).
   (e) What is water hardness explain how water hardness types can be removed and what is typical of Lusaka water? (5 Points).

3. Waste water is water with potential to pollute the environment if it is not well treated mention the important waste water purification steps starting from the in fluent, aeration clarification and decantation the recycling of the sludge, effluent production and quality sludge production and treatment, the role of the microbial community in this aspect and the significance of the microbial community. Describe the type of waste water not recommended for this environment and explain why you would not want this type of waste water if you were the manager of this plant (20 Points)

4. (a) Name the three principal ways which cause sludge variations (3 Points)
   (b) What is NOD, what is its significance in wastewater treatment, and what types of microorganisms are associated with NOD (5 Points)

(c) What is the purpose of activated sludges, also mention two important characteristics that distinguish activated sludge systems from conventional microbial fermentation. (5 Points)

(d) Name the two species of flies that affect trickling filters how are they a Problem. How can the problem of flies be controlled in the trickling filters? (5 Points)

(e) What is Ponding and what causes? (2 Points)

5. (a)What is sloughing off how is this related to the normal operation of a trickling filter? (5 Points).

(b) What are the 4 characteristics of a bulking sludge? And how can it be controlled (10 Points)

(f) What is TOD what is its major limitation (2 Points)

(g) What is F_b mean and what does it represent in your explanation give the equation representation as well. (3 Points)

6. (a) Name the five factors affecting effluent quality. Explain in detail how each one of them affects the quality. How can effluent variability be minimized (10 Points)

(b) Describe in detail the 6 reactions occurring in the activated sludges and the significance of each reaction. While all these reactions are occurring describe the status of the microbial community in general (10 Points

THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

FIRST SEMESTER EXAMINATIONS-AUGUST 2003

AGF 422 - NUTRITION

TIME: THREE HOURS

INSTRUCTIONS: Each question carries 20 marks. Answer 5 Questions Only.

1. Describe the clinical effects of fiber in each of the following disease states:

    a) Diverticulosis
    b) Diabetes mellitus
    c) Colon cancer
    d) Obesity
    e) Hyperlipdemia (elevated lipid levels in blood especially cholesterol)

2. Identify **two** common problems associated with pregnancy, describing the dietary management of each.

3. What factors are considered in setting nutrient intake recommendations (RDA)? In brief describe the diet planning guides used in Zambia.

4. Discuss weaning with particular emphasis on the following:
    -   definition
    -   frequency of feeding
    -   Reducing bulk from the weaning foods.
    -   Introducing solid foods to the diet and withdrawal of breast milk from the diet.
    -   Chronic energy malnutrition and weaning
    -   Exclusive breasting

5. In Zambia (Demography and Health Survey 2000) it is reported that 50% of mothers attending antenatal clinics have chronic energy deficiency and are anaemic.

    a) What are the manifestation of chronic energy deficiency (CED)
    b) What are the causes of this anaemia seen in pregnancy
    c) What recommendations would you give to the pregnant woman to maximise her food intake.

6. Write a brief on each of the following:

    a) Carbohydrates
    b) Proteins
    c) Niacin
    d) Kilocalories

End of Exam

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

FIRST SEMESTER EXAMINATIONS-AUGUST 2003

AGF 531 – TECHNOLOGY OF PLANT PRODUCTS

TIME: THREE HOURS

INSTRUCTIONS: Answer all questions
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Question 1

Discuss the principle, possibilities and limitations of interesterification of vegetable oils

Question 2

Compare the dry and wet milling processes of corn

Question 3

Discuss composition and properties of soy milk. Compare soy milk with cow's milk.

End of Exam

TIME: THREE HOURS

INSTRUCTIONS: Answer all questions
===

Question 1

Discuss the importance of caseins in cheese production. Why is it difficult to make a classical ripened cheese from horse's milk

Question 2

What is the influence of milk fermentation lactose digestability?

Question 3

Discuss the production process of butter. Include a discussion on the chemical and microbiological stability of butter.

End of Exam

THE UNIVERSITY OF ZAMBIA

AGG 311 Statistics and experimental design

FINAL EXAMINATION   AUGUST 2003

Instructions
1. Answer all questions.
2. The marks for each question are indicated
3. Maximum time allowed = 3 hours
4. An annex is included of some useful formulas

1. Write short notes on:
   a. Inductive and deductive reasoning. [5 marks]
   b. The scientific methodology of processing problems. [5 marks]
   c. Principles of experimentation used to separate treatment effects from random error. [5 marks]

2. Describe how you would carry out an experiment and analyse the data to test for differences among three types of phosphate fertiliser and four varieties of maize. In this experiment the response (= measurement) variable is grain yield in tons/ha. [20 marks]

3. Given that the error mean square from an experiment that carried four replications is 0.82, separate the means below using the LSD at 5 % probability level (df for MSE is 45):
   Mean 1 = 68.3
   Mean 2 = 68.6
   Mean 3 = 74.5
   Mean 4 = 75.7
   Mean 5 = 70.1
   Mean 6 = 73.4   [15 marks]

4. You are given data in the table below. Fit a regression model to this data and predict the value of y when x = 16.4.

| x | 14.6 | 21.1 | 17.4 | 15.4 | 18.6 | 23.9 | 19.8 | 16.1 | 15.3 | 17.6 | 18.2 | 22.2 |
| y | 58.7 | 79.3 | 71.4 | 61.1 | 72.4 | 84.9 | 75.4 | 67.0 | 62.4 | 68.2 | 74.3 | 81.7 |

[20 marks]

5. An experiment to compare four feeds (A, B, C and D) on milk production used a Latin square design. Single Friesian cows were used as experimental units. Each cow was fed on one randomly chosen feed for two weeks after which daily milk yield (litres) was measured and totalled up for one week. Each cow was then fed on the next feed and the

1

procedure repeated until each cow had been fed all four feeds and milk yields recorded. [The reason for measuring the milk yield only in the third week was to remove any carryover effect of the previous feeds].

Analyse the data below and test the hypothesis that the feeds are not different in their effect on milk yield.

Period	Cow			
	1	2	3	4
1	A = 91.1	B = 92.6	C = 146.1	D = 119.6
2	B = 90.1	D = 96.6	A = 104.0	C = 100.9
3	C= 103.2	A = 76.8	D = 116.7	B = 87.3
4	D = 107.5	C = 77.0	B = 101.3	A = 71.7

[30 marks]

Annex: Sums of squares for a Latin square design

1. $CF = G^2/p^2$
2. Total SS = $\sum x^2 - CF$
3. Row SS: $SS_R = \sum R^2/p - CF$
4. Column SS: $SS_C = \sum C^2/p - CF$
5. Treatment SS: $SS_t = \sum T^2/p - CF$

Damsels and lads, it has been a great pleasure to introduce you to the basics of experimentation. I wish you everything of the best in courses to follow—CG.
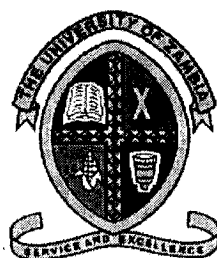
THE UNIVERSITY OF ZAMBIA

AGG 521 Plant Breeding II

FINAL EXAMINATION   AUGUST 2003

Instructions
1. Answer all questions.
2. The marks for each question are indicated
3. Maximum time allowed = 3 hours

1. Describe the main procedures involved in acquisition and utilisation of germplasm. [20 marks]

2. Describe Design I of Comstock and Robinson (= NC I) and what it is used for. [15 marks]

3.
   a) Describe how one group of chemicals and one group of ionising radiation cause mutations. [10 marks]
   b) You are working to improve resistance to rosette, a viral disease in groundnuts. You have one highly preferred variety in the country. You have failed to obtain material that has resistance form possible sources. Describe what option you would take and how you would go about to achieve your objective. [15 marks]

4.
   a) Outline how you would rapidly produce <u>virus free</u> banana plantlets using an in vitro system. [20 marks]
   b) What are the advantages and disadvantages of producing propagules by in *vitro* methods over the conventional systems? [10 marks]

5. Write short notes on
   a) The biollistic method of plant transformation [4 marks]
   b) General and specific combining ability [3 marks]
   c) The components of variance of a population [3 marks]

Damsels and lads, it has been a great pleasure to see you through the final stages of undergraduate plant breeding. As you prepare to take up your posts as breeders, remember, breeding is both an art and a science: the science has been given, be humble enough to learn the art in the field--CG

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

UNIVERISTY FIRST SEMESTER EXAMINATIONS - AUGUST, 2003

AGS 211: FUNDAMENTALS OF SOIL SCIENCE

TIME: 3 HOURS   MARKS: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS
QUESTIONS IN SECTION A SHOULD BE ANSWERED ON THE
QUESTION PAPER.

SECTION A

1.   Complete the following Table with appropriate missing terms [5 marks]

Deposition Agent	Name of deposit	Land Form
Flowing water	....	....
....	Lacustrine	....
....	....	dune/loess hill
Glacier	....	....
....	....	Tallus/soil creep

2.   Complete the following Table with appropriate missing terms [5 marks]

Rock name	Igneous, Metamorphic, sedimentary
Gneiss	....
Limestone	....
Mudstone	....
Phyllite	....
Sandstone	....
Granite	....
Quartzite	....
Marble	....
Ironstone	....
Coal	....

3. Indicate true (T) or false (F) against each of the following statements.
   [10 marks]

   - Talc belongs to the oxide group of minerals.................

   - Basalt is a plutonic igneous rock...................….

   - Pyroxene is a ferromagnesian silicate............

   - Rocks from magma are fine-grained while those from lava are are coarse-grained.........

   - High silica content in molten rock results in an explosive volcano.........

   - Kaolonite is a very resistant layer silicate mineral.................

   - The resistance of minerals to weathering is related to the number of shared oxygen ions in the basic crystal structure................

   - The primary minerals (mica) are related in structure to secondary clay minerals....................

   - The Batoka basalt, petrified wood (Chirundu) and deposits of coal (Gwembe) belong to the Karoo System of stratigraphy in Zambia.............

   - Gypsum is an example of a carbonate mineral.........................

SECTION B

4. A solid particle sedimenting in water is subject to the frictional force $F_r = 6\pi\eta rv_t$ and gravitational force $F_g = 4/3\pi r^3 (\rho_s-\rho_f)$ where v_t is the terminal velocity, r is the radius of the particle, ρ_s is the particle density (2.65×10^3 kg m^{-3}) and ρ_f is the liquid density, η is the viscosity = 0.001 N s^{-1} m^2.

   a) Derive an equation relating v_t to the particle radius [4 marks]

   b) How long will sand and clay particles take to sediment through a 10 cm water column under room temperature conditions? [6 marks]

5. a) Describe the attributes of microorganisms that make them uniquely successful in the environment [5 marks]

   b) Describe the characteristics of the clay fraction that make it a major determinant of major soil properties and physico-chemical reactivity. [10 marks]

6. Why do the following processes make soil parent material unstable and more susceptible to weathering.

    a)   Hydrolysis [4 marks]

    b)   Hydration [3 marks]

    c)   Carbonation [4 marks]

    d)   Oxidation and reduction [9 marks]

7. Discuss the influence of parent material, vegetation and climate on pedogenesis, citing specific examples from Zambia. [10 marks]

8. a)   Calculate the net charge on the surfaces of the following minerals in which isomorphous substitution has occurred [9 marks]

          Pyrophyllite (Talc) $Al_4 si_8 O_{20} (OH)_4$

          Kaolinite $Al_4Si_4 O_{10} (OH)_8$

          Montmorrillonite $(Al_{3.5}Mg_{0.5}) Si_8 O_{20} (OH)_4$ x H_2O

          Muscovite $Al_4 Si_6 Al_2 (OH)_4 .x K^+$

    b)   Distinguish between: [6 marks]

          i)   plutonic and volcanic rocks

          ii)   contact and regional metamorphism

          iii) fossil and petrified wood

9. A soil sample was obtained from a field and placed in a can, weighed and dried in an oven at 105°C overnight and re-weighed. The following data were obtained: field soil plus can = 195g; oven-dry soil plus can = 143g and the empty can = 41g. Calculate [10 marks]

    a)   The percentage gravimetric

    b)   Percent volumetric water content given a soil bulk density of 1.3g cm^{-3}

    c)   The depth to which 30 mm of rainfall would wet the soil.

END OF EXAMINATION

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
UNIVERSITY FIRST SEMESTER EXAMINATIONS-AUGUST, 2003

AGS 311: AGROCLIMATOLOGY

Time: Three (3) Hours   **Marks**: 90

Instruction: Answer all Questions

Note that for calculated values the number of decimal places should be rounded off to between one to three decimal places where possible

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1. Briefly define each of the following terms used as applied in Agroclimatology   (*10 marks*)
    a) Solar constant
    b) Psychrometric constant
    c) Climate
    d) Aerodynamic resistance
    e) Reference evapotranspiration

2. The sun and its influence on the earth's atmosphere are important in environmental management
                                                                                         (*10 marks*)
    a) List five basic characteristics of the sun in the solar system that are important for controlling the weather in the earth's atmosphere
    b) Discuss briefly five causes of data non-homogeneity for agricultural applications in climatic data analysis

3. Discuss   (*10 marks*)
    a) Factors that determine the crop coefficient
    b) The primary characteristics that distinguish the crop from reference grass surface in the crop coefficient approach for determining crop evapotranspiration

4. List five basic characteristics of the <u>two</u> most commonly used devices for measuring water evaporation in meteorological stations   (*10 marks*)

5. Crops are sensitive to radiation   (*15 marks*)
    a) What is the proportional distribution of total radiant energy received by the plant
    b) With the aid of specific wavelength band, what are their effects of radiation on plant growth

6. Given the following information on crop water requirements for maize under rainfed conditions
   (10 marks)

Growth stage	I	II	III	IV
ET_0 (mm day^{-1})	5.9	6.4	5.8	5.6
kc	0.15	0.75	1.20	0.50
Length (days)	25	30	50	35
Rainfall (mm)	50	270	305	100

a) Determine the crop water requirement for each growth stage (mm)
b) Determine the total crop water requirement for the whole season expressed in m^3 per ha
c) Did the crop experience any water deficit during the season and by how much if any (m^3 per ha)?
d) How would you use this information in drought-prone areas of Zambia?

7. Given the following meteorological data measured this year (2003) at Msekera Regional Research Station (13°38' S, 32°34' E and altitude 1025 m) located about 12 km west of Chipata town:
   (25 marks)

Maximum air temperature	26.9°C
Minimum air temperature	19.2°C
Maximum relative humidity	100 %
Minimum relative humidity	66 %
Wind speed measured at 10 m height	10 km hr^{-1}
Estimated extraterrestrial radiation	40.5 MJ m^2 day^1
Solarimeter measured solar radiation	267.496 W m^{-2}
Solar inclination	-0.370 radians

$1.0 \, MJ \, m^2 \, day^1 = 11.6 \, W \, m^{-2}$

Calculate:
a) Atmospheric pressure for Msekera
b) Actual sunshine duration in hours
c) The date of this measurement (day and month)
d) Dewpoint temperature in degree Celsius
e) Slope of the saturation vapour pressure curve at the mean temperature

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End of Exam

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY FIRST SEMESTER EXAMINATIONS – AUGUST 2003

AGS 411 SOIL FERTILITY

TIME: 3 HOURS   MARKS: 100
INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1.   Explain three (3) ways in which ions move from soils to roots. [3 marks]

2.   a)   Explain the following terms:

           i)   alkalinization

           ii)   salinization due to irrigation

           iii)   sodication

           iv)   electrical conductivity   [4 marks]

    b)   If a farmer presents you with soil analysis results of a soil sample which has a pH of more than 8.5.

           i)   What would be your comments on exchangeable sodium percentage and soil salinity?

           ii)   What are the likely soil chemical and physical problems the farmer anticipate?

           iii)   What would be your advice on how to correct the situation? [6 marks]

3.   a)   What is organic matter mineralization? [1 mark]

    b)   Discuss the fluctuations of organic matter mineralization in the course of the year, giving reasons for the fluctuations. [6 marks]

    c)   What is the importance of leaching in terms of N availability? Explain. [2 marks]

    d)   How can the problem of N leaching be minimized? [1 mark]

4.   a)   Give six (6) reasons why soil organic matter is important in the maintenance of soil fertility and productivity. [6 marks]

    b)   What is green manure and what is compost? [2 marks]

c) What is organic (farming) agriculture? [2 marks]

5. a) What is potential acidity? [1 mark]

b) Why is the ammonium acetate used for determination of CEC buffered at pH 7? [2 marks]

c) What is Anion Exchange Capacity and what is its importance in comparison to Cation Exchange Capacity? [3 marks]

6. a) What is meant by ions being

i) adsorbed? [1 mark]
ii) exchangeable? [1 mark]

b) What is a lyotropic series? Give an example? [2 marks]

c) What is complementary ion effect? [2 marks]

d) Why are nutrient ratios important in the interpretation of soil test results? [2 marks]

7. There is a law which says "yields can only be as high as permitted by the minimum factor".

a) What law is this? [2 marks]

b) Explain what this law means. [2 marks]

c) In what way is soil and plant analysis connected to this law? [2 marks]

8. a) What is soil pH? [1 mark]

b) Explain two (2) principles used in any two methods of soil pH determination. [2 marks]

c) Why is soil pH important in nutrient availability considerations? Give examples. [3 marks]

d) Explain four (4) factors which affect soil pH measurements. [4 marks]

9. a) What are the possible reasons for carrying out plant analysis?[4 marks]

b) List the difficulties faced in interpretation of plant analysis results. [4 marks]

10. a) What is soil testing? [2 marks]

b) Explain the four (4) stages of soil testing, giving reasons why you feel each stage is important. [4 marks]

c) As you take soil samples you need to have accompanying information. What type of information do you need and why? [4 marks]

11. a) What are multinutrient fertilizers? [1 mark]

b) Calculate the amounts of ammonium nitrate (34% N), single super phosphate (20% P_2O_5) and potassium chloride (60% K_2O) needed to prepare a one tonne 6-15-6 compound fertilizer. [3 marks]

c) How much of additional materials do you need in the compound fertilizer of 11b) above? [1 mark]

12. a) If a commercial farmer has to buy fertilizers for 100 hectares of maize, what economic factors does he/she need to consider so that the cost is kept to the minimum? [4 marks]

b) How do plants such as rice survive under waterlogged and submerged soils? [2 marks]

c) Describe the effect of pH on the different nutrients such as N, P, Fe, Mn, S, Ca and K in submerged soils. [8 marks]

END OF EXAMINATION

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

FIRST SEMESTER FINAL EXAMINATION-AUGUST 2003

AGS431- SOIL MINERALOGY AND MICROMORPHOLOGY

TIME: 3 HOURS MARKS: 100
INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

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1. Define the following terms (8 marks)
   a. Siallitization
   b. Solvation
   c. Integral thermal analysis
   d. Trioctahedral phyllosilicate

2. Indicate whether the following statements are true or false. (10 marks)

   a. Kaolinite is one of the minerals considered to be resistant to weathering

   b. Muscovite is a ferromagnesian phyllosilicate.

   c. Calcite can form from the weathering of Olivine

   d. A crystal face with Miller Indices (021) is parallel to the a-axis and intersects the b-axis at a distance of ½ the unit length from the centre of the crystal.

   e. Sodium dithionite is the reagent used to remove carbonates from calcareous soils during the preparation of samples for X-ray diffraction analysis.

   f. The presence of rounded zircon crystals in the heavy minerals of the sand fraction of a soil is an indicator of a lithological discontinuity in the soil profile.

   g. The ordinary petrography microscope cannot be used to identify the crystallographic properties of montmorrillonite in a soil sample.

   h. Bragg's equation states that constructive interference of monochromatic X-rays that are in phase before interacting with a mineral, occurs when the condition $n\lambda = dsin2\Theta$ is satisfied.

   i. The terms acicular, tabular and fibrous are used when describing the crystal habit.

   j. Pleochroism is studies under crossed polarized light.

3.

   a. What is the role of leaching in chemical weathering (3 marks)

   b. What are the processes involved in the weathering of silicate minerals (3 marks)

   c. Discuss how the Eh (Redox potential), fixation and chelation influence the mobility of common cations in soils. (6 marks)

4.

   a. What is the role of soil fractionation and chemical analysis in soil mineralogical studies? (2 marks)

   b. Define mineral separation and describe what is involved in mineral separation. (4 marks).

   c. The criteria used in classifying rocks are the origin, grain size and mineralogical composition. Based on these criteria, there are three major groups of rocks that are universally recognized.

      (i) What are these three major groups of rocks? (3 marks)

      (ii) How are these groups of rocks formed? (3 marks)

      (iii) Give examples of a rock from each of these three groups of rocks. (3 marks).

5.

   a. What are iron and aluminum hydrous oxide clays? Give examples. (4 marks).

   b. How do the characteristics of iron and aluminum hydrous oxide clays affect the physical and chemical aspects of soil fertility? (6 marks).

6. An optical study of the heavy minerals in the sand fraction of the subsurface horizon of a soil from UNZA Farm revealed the following mineralogical composition:

Mineral	Number of minerals counted
Opaque	270
Tourmaline	12
Rutile	19
Zircon (mostly rounded)	22
Kyanite	10
Sillimanite	3
Unidentified	30

Based on the above information, answer the following questions:

   a. What is the percentage and of standard deviation of the percentage of zircon present in the sample? (5 marks)

b. How many mineral grains would you have to count to get a standard error of 5 % for the proportion of kyanite at 95% level of significance, given that $t_{\alpha=0.05}$ is 1.98? (5 marks)

c. From the above mineralogical composition of the heavy minerals, what can you infer about the origin and nature of the parent material from which this soil formed? (5 marks).

d. The mineral tourmaline, one of the constituents of the heavy minerals is a boron bearing cyclo-silicate which is uniaxial negative and belongs to the Trigonal System.

   I. How many refractive indices does this mineral have? Give reasons to support your answer (5 marks)

   II. Draw the indicatrix of this mineral showing the orientation of the fast and slow rays? (5 marks).

   7. Kaolinite and dioctahedral micas are common constituents of the clay fraction of most well drained soils of Region II of Zambia. The characteristic d-pacings of kaolinite are 0.72 nm and 0.36nm, while those of dioctahedral micas are 1.0nm, 0.5 nm and 0.33 nm.

a. Indicate the values of the angle 2Θ, at which peaks corresponding to the above d-spacings would occur on a diffractogram from an X-ray diffraction machine that uses Cu $_{K\alpha}$ radiation with a wavelength of 0.154nm. (10 marks).

b. The chemical formulae of Kaolinite and muscovite, a dioctahedral mica, are $Al_2Si_2O_5(OH)_4$ and $KAl_2(AlSi_3)O_{10}(OH)_2$ respectively. Kaolinite losses 14 % of its mass at 550° C, due to the loss of its hydroxyl ions. The results of the chemical analysis of the clay fraction of the soil show that the sample contains 1.2 % K, while a thermo-gravimetric analysis of 35 grams of the clay recorded a weight loss of 3 grams at 550° C.

   I. Assuming that all the potassium in the clay sample is associated with the mica; calculate the percentage of muscovite present in the clay fraction of the soil? (5 marks).

   II. What is the percentage of Kaolinite in the clay fraction of the soil? (5marks).

   Note: Atomic masses for the elements of interest are:

   Al = 27, Si = 28, H = 1, K = 39, O =16.

   END OF EXAM

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES
UNIVERSITY FIRST SEMESTER EXAMINATIONS-AUGUST, 2003

AGS 441: AGRICULTURAL HYDRAULICS AND HYDROLOGY

Time: Three (3) Hours   **Marks:** 85

Instruction: Answer all Questions

1. Briefly define each of the following terms: (*10 marks*)
   a) Weight and mass
   b) Vector diagram
   c) Kinematic viscosity
   d) Stilling basin
   e) Reynolds number

2. If you were requested to design channels for a furrow irrigation system in Zambia, what would be your basic guidelines for coming up with design problem   (*10 marks*)

3. With the aid of a diagram define the different components of specific energy in a channel used to supply water to a farm and give some important points about the specific energy in channel design   (*15 marks*)

4. Pumps are a means of adding energy to water. Discuss the different types of positive displacement pumps that can be used for irrigation   (*20 marks*)

5. Kaleya Small-holder irrigation scheme in Mazabuka have constructed a 1km pipeline with a diameter of 100cm to deliver water from the Kafue River to their main reservoir for redistribution into farm blocks. For redistribution from the reservoir to each farm block, irrigation water is supplied through open rectangular channels which are 2.3m wide. The first hydraulic Jump is constructed 500m away from the farm block a channel discharge of $2.5m^3s^{-1}$ with an upstream depth of 0.25m   (*20 marks*)
   Calculate:
   a) Velocity (ms^{-1}) in the pipe given the elevation difference of 15m and pipe friction factor of 0.04
   b) Froude number for the channel flow
   c) Depth of flow downstream for the Jump (m)
   d) Energy loss in the Jump (m)

6. A fountain is designed for the Goma lakes. A nozzle diameter of 50mm is chosen and the water velocity at the nozzle will be 8.5 ms⁻¹ (*10 marks*)

   a) Calculate the height to which the water will rise

   b) If the jet of water passes through a circular opening 2m above the nozzle, calculate the diameter of the opening

---

End of Exam

TIME: THREE HOURS

INSTRUCTION: ANSWER ALL QUESTIONS   (POINTS IN PARENTHESIS)

1. Define or explain briefly the meaning of each of the following: (10 points)

   a. Exchangeable K
   b. Common ion effect
   c. Zeta potential
   d. Surface functional group
   e. Colloid

2. Calculate the activity coefficient for Ca in a solution containing 7.3×10^{-3} M KCl and 2×10^{-3} M Ca Cl_2 using the following:

   a. The Debye-Huckel limited equation where ions are considered as point charges (5 points).

   b. The Debye-Huckel extended equation where the effective diameter of all ions is averaged at 3, that is Bd = 1. (5 points).

3. You are growing a plant in a pot to which you have applied phosphorus fertilizer. If the soil is a moderately acid alfisol, explain the thermodynamic reactions of the fertilizer in and with the soil, and how the plant will take up P from the soil. (10 points).

4. Compare the shape of the pH vs me of NaOH curves for both aged and fresh H+ clays. Explain the chemical reactions in each region of the curve. (5 points).

5. At a recent meeting it was stated that "acid rain" is of no practical concern to agriculture in Zambia. Do you agree with this statement? Defend your position. (5 points).

6. In a laboratory experiment, NaOH was used to increase the pH of soil samples to study the effect of pH on Mn equilibria. But the Na+ ions present dispersed the soil to the point that it could not be filtered. Using your knowledge of cation exchange and diffuse double layer concept as well as your laboratory saavy

   a. Explain how this is possible (5 points).

   b. How would you recommend separating the liquid from the solid phase? (5 points)

   Double layer eq. $= \dfrac{\sqrt{DKt}}{\varepsilon\sqrt{8\pi}\sqrt{\mu}}$

   (You are expected to explain the chemistry behind your rationale in each case).

7. From the following thermodynamic data:

Species	ΔG_f^0 (kcal)
e-	0
H	0
OH-	-37.594
Fe^{+2}	-21.80
Fe^{+3}	-4.02
H_2O	-56.687
$Fe(OH)_3$	-170.40

Calculate:
   a. The dissociation constant of water (5 points).

   b. Log K for the reaction. (5 points).

   $$Fe(OH)_3 \longleftrightarrow Fe^{3+} + 3OH^-$$

8. You have an opportunity to be retained as Consultant on a project to increase agricultural production and productivity in the high rainfall zone of northern Zambia. You have been asked to submit a proposal for work that will look at the limitations to soil productivity in this region. What are the soil chemistry limitations there and why? What are the possible remedies? (20 points).

9. Discuss the use of pe in evaluating oxidation-reduction reactions in the soil. (10 points).

10. Discuss the factors that govern the chemical reactivity of soils. (10 points).

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY FIRST SEMESTER EXAMINATION - AUGUST 2003

AGS 531. LAND EVALUATION AND IMPROVEMENT

TIME: 3 Hours   MARKS: 70
INSTRUCTIONS: ANSWER ALL QUESTIONS AND WRITE LEGIBLY

1.   Define the following terms:

   a)   Land adaptation

   b)   Land resources

   c)   Land characteristic

   d)   Land use planning

   e)   Major Land improvement   [10 marks]

2.   a)   In principle, parametric and non-parametric land evaluation methods produce
            different results. They however have some degree of similarity in their operation.
            Suggest and explain any similarities between the two methods. [6 marks]

      b.   Discuss in detail the main advantages and disadvantages of qualitative land
            evaluation methods. [4 marks]

3.   Using suitable illustrations, where necessary, discuss the main land characteristics that
      define Zambia's agro-ecological zones. [10 marks]

4.   a)   Should the land use requirements of the various land utilization types be set up
            before or after the mapping and description of different types of land? Explain.
            [6 marks]

      b)   Why is information about the soils of an area important in land evaluation?
            [4 marks]

5. With suitable examples, explain the concepts of:

   a)   land characteristics

   b)   land qualities

   c)   land units

   d)   land utilization type

   e)   farming system   [10 marks]

6. A land unit near Sinazongwe Boma, in Southern Province, is represented by information in Soil Profile No. 27, attached below. Using a qualitative land evaluation method of your choice assess the general land suitability of this land unit. Explain your choice of the method. [10 marks]

7. a)   Using the Storie Index, assess the general productivity of the land unit you have just assessed in Question 6. [5 marks]

   b)   Given the following additional information:

Crop	Fertilizer Requirements (kg/ha)		Potential Yields (t/ha)	Producer prices (K/kg)	Cost to transport produce to nearest market (K/100kg)
	Basal dressing (D Compound)	Top dressing (Urea)			
Maize	100	100	10.0	1000.00	50.00
Sunflower	100	100	4.0	2000.00	50.00
Soybeans	100	-	8.0	1200.00	20.00
Cotton	100	60	4.0	3500.00	30.00
Sorghum	100	100	8.0	1000.00	75.00

Fertilizer prices   =   K75,000/50kg D Compound; K60,000/50kg Urea.

Total Area of land unit   =   10ha

Recommend three most suitable crops on this land unit; assuming your decision is based purely on economic profitability. [5 marks]

END OF EXAMINATION

UNIVERSITY OF ZAMBIA

SCHOOL OF AGRICULTURAL SCIENCES

UNIVERSITY FIRST SEMESTER EXAMINATIONS-AUGUST, 2003

AGS 551: PLANNING AND DEVELOPMENT OF IRRIGATION AND DRAINAGE SYSTEMS

Time: Three (3) Hours   **Marks**: 90

Instruction: Answer all Questions

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1. Briefly define each of the following terms: (*10 marks*)
    a) Tile drain
    b) Pipe couplers
    c) emitters
    d) contact time
    e) command line

2. If you were requested to design drainage systems in Zambia, what are the likely <u>five</u> origins of excess water and <u>ten</u> benefits of drainage systems?   (*15 marks*)

3. The dupuit equation relate drawdown with discharge for steady radial flow to a well completely penetrating a confined aquifer   (*20 marks*)
    a) With a diagram, derive the equation for well discharge and transmissivity
    b) What are assumptions for its valid applications?

4. Explain the design factors that should be considered for: (*10 marks*)
    a) Fallow irrigation layouts
    b) border strip layout

5. Briefly describe the <u>system components</u> and the <u>planning criteria</u> for an overhead irrigation system that can be applied in Zambia   (*20 marks*)

6. During a pumping test in a dambo wetland from an open well with discharge of 0.05 m³s⁻¹ and diameter of 30cm penetrating fully in an unconfined aquifer, the following observations were made: (*15 marks*)

	Reference level (m)
Initial water surface before pumping started	228
Water in the well at constant pumping	223
Water in observation well located 50m from the well	227
Impervious well	200

Determine

a) Depth of water (mm) applied to 10 hectare field in one day

b) Coefficient of permeability of the aquifer (m day⁻¹)

c) Transmissivity of the aquifer (m² day⁻¹)

d) Radius of influence of the pumping (m)

End of Exam

THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
AGRICULTURAL ENGINEERING DEPARTMENT
FIRST SEMESTER FINAL EXAMINATIONS, AUGUST 2003
EA 311 (FARM POWER AND MACHINERY)

INSTRUCTIONS

TIME ALLOWED: **THREE HOURS**

ATTEMPT: **FIVE** QUESTIONS ONLY; <u>AT LEAST **TWO FROM EACH OF THE TWO SECTIONS**</u>

ALL QUESTIONS CARRY **EQUAL MARKS** (20 MARKS EACH).

THIS QUESTION PAPER COMPRISES **EIGHT** QUESTIONS.

SECTION A

1. A four cylinder four stroke cycle engine with a 1-3-4-2 firing order is given in **Table Q1a.** below.

Table Q1a

Crank travel	Cylinder number			
	1	2	3	4
180°	Power			
360°			Power	
540°				Power
720°		Power		

   a) Make a similar table for a six cylinder four stroke cycle engine with a 1-4-2-6-3-5 firing order by first determining the angle between any two power strokes that immediately follow each other. Use **Table Q1b** on the last page of this Examination Paper to answer this question.

[10 marks]

   b) What is the ratio of the crankshaft gear to the camshaft gear for the six cylinder engine in the above question.

[2 marks]

   c) **True** or **False**? "For an engine operated at variable speeds, a lighter flywheel is needed."

[2 marks]

   d) State **three** functions that piston rings perform in an engine.

[6 marks]

2. Given an 81mm x 77mm four cylinder engine, calculate:
   a) the crank radius. [2 marks]

   b) the piston displacement. [2 marks]

   c) the total cylinder volume. [2 marks]

   d) the engine displacement. [2 marks]

   e) the compression ratio (given that **CV=PD/7.5**). [3 marks]

   f) From the compression ratio above, state the type of fuel used in the engine and list five main parts of the fuel system.

   [6 marks]

   g) How is ignition achieved in the engine above.

   [3 marks]

3. a) List the functions of a governor.

   [2 marks]

   b) What does a mechanical governor control in:
   i) a petrol engine?

   [1 mark]

   ii) a diesel engine?

   [2 marks]

   c) Make a sketch of the diesel fuel system and label four main parts.

   [8 marks]

   d) Describe the oil mist lubrication system.

   [4 marks]

   e) Briefly explain why an electric powered tractor would be preferred to a diesel-powered tractor for use in a green house.

   [3 marks]

4. a) With reference to Figure Q4 list the parts **A** to **G**.

   [7 marks]

   b) How many cylinders does this engine have? Give reasons for your answer.
   [3 marks]

   c) Describe how mechanical power is generated in this engine. Assume it is a four stroke engine.

   [5 marks]

   d) What are the functions of parts D, E, F, G.

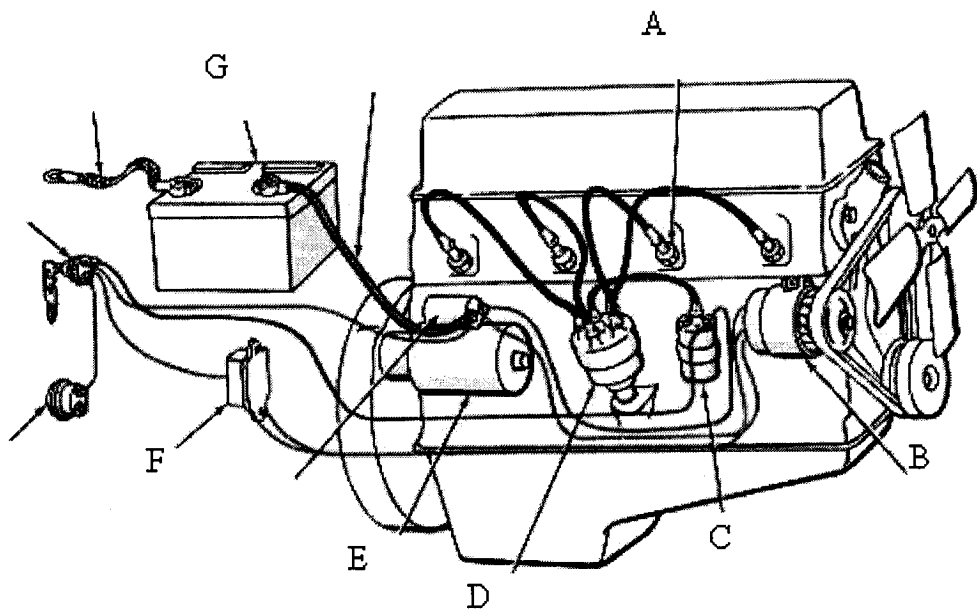   [5 marks]

Figure Q4

5. a) With reference to figure Q5 name the implement and state what operation it is used for.
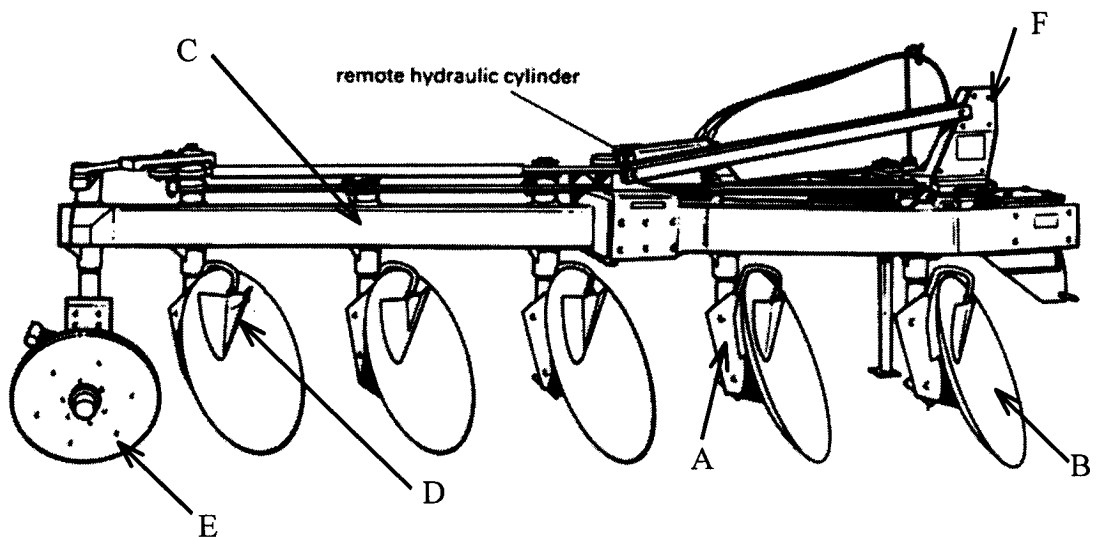
[4 marks]

remote hydraulic cylinder

Figure Q5

b) Name the parts A to E and for each part state it's function.

[12 marks]

c) If the effective width of this implement is 1.8m and is drawn at 10 km/hr, with a field efficiency of 87%, calculate the work rate in hectares per hour (ha/hr).

[4 marks]

3

6. a) List **three** advantages of row cropping

    [5 marks]

    b) Distinguish between primary tillage, secondary tillage and cultivation tillage. For each type of tillage, list <u>two</u> tillage implements that may be used.

    [8 marks]

    c) What is conservation farming? List **four** advantages of conservation farming and name the implements used.

    [7 marks]

7. a) Outline the steps involved in planting maize seeds.

    [7 marks]

    b) What is the difference between a planter and a seed drill.

    [3 marks]

    c) List **four** components of a seed drill and for each part, state its function.

    [6 marks]

    d) Name **four** parts of a tractor mounted sprayer.

    [4 marks]

8. a) State **four** factors that influence the method and type of equipment used for land clearing.

    [2 marks]

    b) Outline **four** objectives for carrying out tillage operation during crop production process and name **one** implement that best achieves each objective stated.

    [6 marks]

    c) Describe the general qualities of a suitable seedbed

    [4 marks]

    d) State **two** situations that would encourage the use of a chisel plough for primary tillage and explain why.

    [4 marks]

    e) List **four** parts of a mouldboard plough.

    [4 marks]

Table Q 1b

Crank angle	Cylinder Number							

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

AGRICULTURAL ENGINEERING DEPARTMENT

FIRST SEMESTER EXAMINATIONS, AUGUST 2003

EA 401 (ENERGY SOURCES AND UTILISATION IN AGRICULTURE I)

TIME: THREE HOURS.

ATTEMPT: ANY FIVE QUESTIONS.

ALL QUESTIONS CARRY EQUAL MARKS, (20 MARKS EACH).

THIS QUESTION PAPER COMPRISES SIX QUESTIONS

Question 1

a) Continuous physical power output of a 60 kg human varies with time according to the following equation:

$$P=\left(68 + 932e^{-0.908t^{0.16}}\right)$$

where: P = power output [W]

t = time [s]

i) Calculate the time period (in hours) a sustainable power output of 85 Watts is possible.

[4 marks]

ii) If manual weeding of a maize field requires a continuous physical power input that can be sustained for 15 minutes only, what rest periods would be required if the activity has to be performed for about six hours each day while maintaining the same level of power input?

[4 marks]

b) List any **four** characteristics against which cattle is judged for suitability for draught work.

[4 marks]

c) State **five** characteristics of a good harness.

[5 marks]

d) Calculate the energy consumption (i.e. metabolisable energy) a draught animal requires to give 1 kWh of work output.

[3 marks]

Question 2

a) List the **four** fundamental requirements underlying the practical and economical operation of internal combustion engines and state the significance of each requirement.

[4 marks]

b) With the help of a well-labelled indicator (p-v) diagram, outline the operation of a theoretical Otto Cycle engine.

[4 marks]

c) A farmer is intending to invest in a diesel engine powered hammer mill. The lowest average annual temperature in the area where the hammer mill is to be installed is 5°C. The auto-ignition temperature of diesel fuel is 450°C, the compression ratio of the engine is 14.5:1 and the polytropic constant, n = 1.30.

    i) Determine whether the engine will be able to start during the average coldest day? Explain your answer.

[3 marks]

    ii) If the engine does not start, state **two** modifications that may be done to the engine to guarantee smooth starting all the time.

[3 marks]

d) State **four** advantages and **two** disadvantages of using an electric motor to power the hammer mill?

[6 marks]

Question 3

a) Define the following terms:

    i) fractional distillation

    ii) polymerisation

    iii) hydrogenation

    iv) straight fuels

    v) flash point.

[5 marks]

b) Calculate stoichiometric air to fuel ratio of the following fuels:

    i) Petrol (C_8H_{18})

    ii) Ethanol (C_2H_5OH)

[4 marks]

c) Briefly explain the adjustment required to an engine that currently uses petrol fuel, if it has to switch to ethanol as engine fuel.

[3 marks]

d) How is the engine used in determining the Octane Number of petrol fuels different from ordinary petrol engine?

[2 marks]

e) Name the reference fuels used in determining the Octane and Cetane Number of petrol and diesel fuels respectively and state the associated Octane and Cetane Numbers.

[6 marks]

Question 4

a) Show that the mean radius of a disc clutch: $r_m = \dfrac{\left(d_o^3 - d_i^3\right)}{3\left(d_o^2 - d_i^2\right)}$

where: d_o = outside clutch diameter

d_i = inside clutch diameter **[5 marks]**

b) Briefly explain **three** situations where it would be advantageous to engage the differential lock while carrying out the field operations.

[6 marks]

c) Why is the final drive often located as close as possible to the drive wheel hub? **[4 marks]**

d) Using first principles, derive the expression for the gear ratio of a planet gear where power comes in through the sun gear and out through the planet carrier while the ring gear is held stationary.

[5 marks]

Question 5

a) Why is it necessary to use positive displacement pumps in hydraulic systems?

[3 marks]
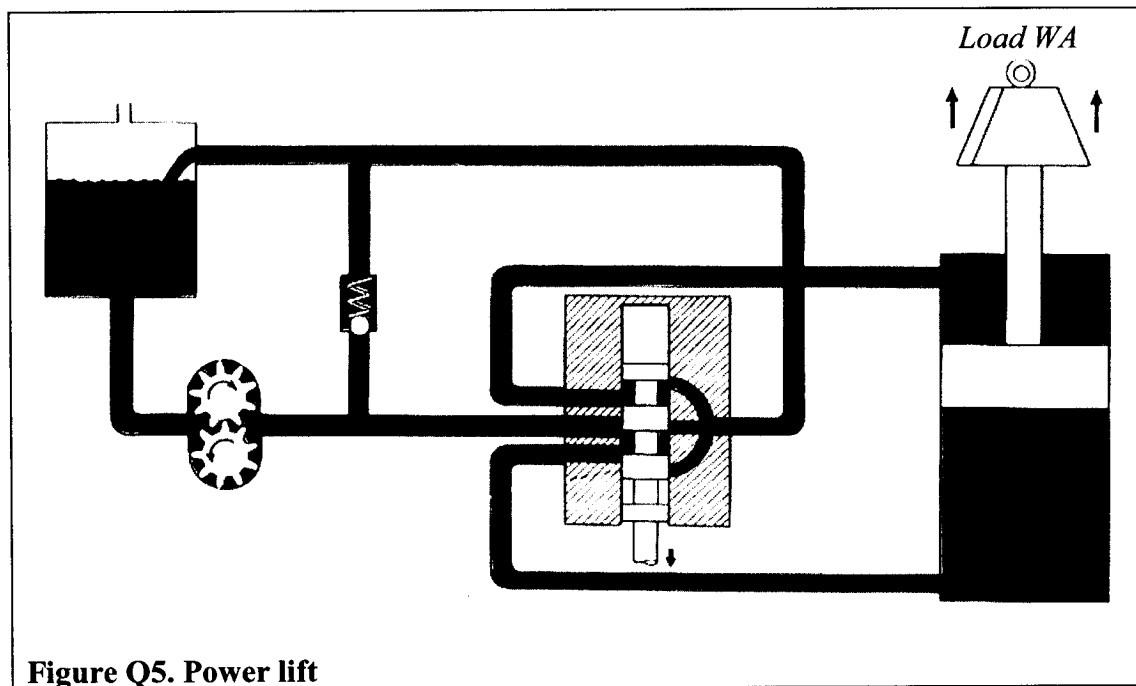
Figure Q5. Power lift

Figure Q5 above shows a schematic diagram of a hydraulic power lift.

b) Draw the hydraulic system using appropriate JIC hydraulic symbols and state the type of hydraulic system used in the power lift .

[5 marks]

c) Given the following specifications of some key components of the hydraulic system in Figure Q6:

Hydraulic pump
Pump displacement = 29.5 cm^3/rev
Rated pump speed = 2500 rev/min
Pump volumetric efficiency = 92.4%

Hydraulic cylinder
Piston diameter = 10.16 cm
Piston rod diameter = 2.54 cm
Stroke length = 20.32 cm

Load
Load WA = 75 kN

i)   Calculate the system pressure   [3 marks]

ii)   How fast will the cylinder move while extending?   [3 marks]

iii) At what rate will the oil be returning to the reservoir when the cylinder is retracting?

[3 marks]

iv)   Calculate the hydraulic power produced by the pump   [3 marks]

Question 6

a)   "Operating an electric power supply system at a low power factor increases transmission costs and reduces line capacity". Explain this statement?

[4 marks]

b)   Outline the procedure for determining the demand load of a building?   [5 marks]

c)   Locate the load centre of the farmstead in Figure Q6.   [3 marks]

d)   Calculate the main service demand load and select the right service ampacity (current capacity) for the farmstead, given the following standard rated packages: 100, 200, 300, 400, 500 and 600 A.

[4 marks]

e)   From Table Q6, select the right size of copper wire needed to maintain a 3% or less voltage drop from the central distribution point to the borehole.
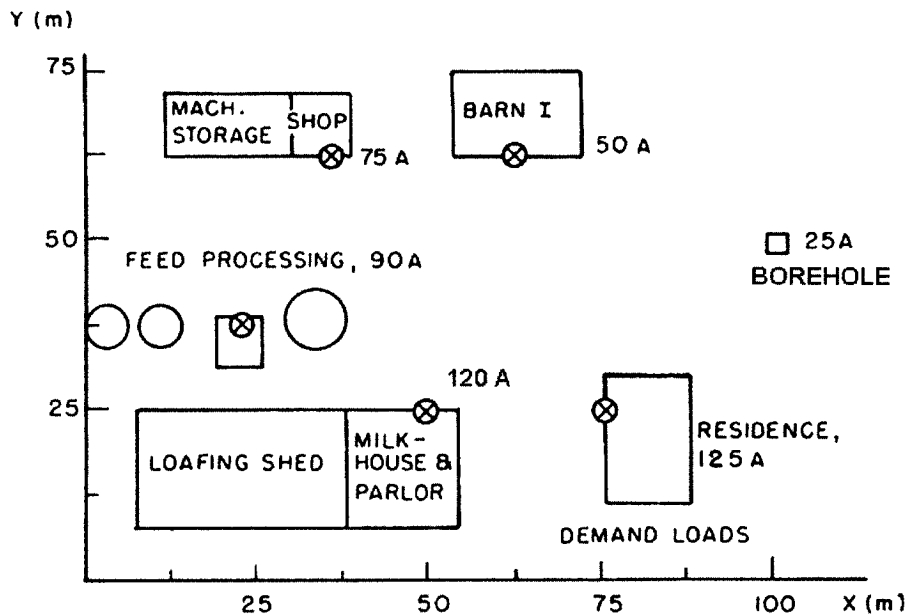
[4 marks]

Figure Q6 Farmstead Layout

Table Q6: Properties of Copper and Aluminium conductors

Size AWG	Diameter (mm)	Areas mm^2	Resistance (Ohm/1000 m)		Weight (kg/1000 m)	
			Copper	Alum	Copper	Alum
0000	11.68	107.22	0.161	0.264	953.06	290.16
000	10.40	85.01	0.203	0.332	755.90	288.67
00	9.27	67.43	0.256	0.421	599.37	181.54
0	8.25	53.49	0.323	0.529	475.42	144.34
1	7.35	42.41	0.457	0.667	376.90	114.43
2	6.54	33.62	0.514	0.841	298.94	90.768
4	5.10	21.15	0.817	1.341	188.08	57.139
6	4.11	13.30	1.299	2.129	118.24	35.861
8	3.29	8.50	2.064	3.385	74.37	22.618
10	2.59	5.26	3.282	5.389	46.768	14.210
12	2.05	3.31	5.218	8.576	29.418	8.928
14	1.63	2.08	8.297	13.60	18.496	5.625
16	1.29	1.31	13.197	21.65	11.633	3.527
18	1.02	0.82	20.981	34.50	7.3165	2.217
20	0.81	0.52	33.35	54.88	4.6009	1.397
22	0.64	0.33	53.04	87.08	2.8942	0.8794
24	0.51	0.20	84.35	138.3	1.8198	0.5520
26	0.40	0.13	134.1	220.2	1.1446	0.3482
28	0.32	0.08	210.3	348.3	0.7197	0.21874
30	0.25	0.05	339.1	555.3	0.4526	0.13749

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

FIRST SEMESTER FINAL EXAMINATIONS, AUGUST 2003

EA 421 (FUNDAMENTALS OF FARM STRUCTURES)

TIME ALLOWED: 3 HOURS   **DATE: 19TH AUGUST 2003**

INSTRUCTIONS:

ANSWER **ALL** QUESTIONS IN **SECTION A** AND ANY **TWO (2) IN SECTION B**.

SECTION A HAS **60 MARKS** AND **SECTION B** HAS **40 MARKS**

USE OF CALCULATORS IS PERMITTED.

A PSYCHROMETRIC CHART WILL BE PROVIDED FOR THE QUESTION 5.

SECTION A.

Question 1

A farmer intends to construct his house using 150 mm Concrete blocks. The blocks are to be made from a 1:3:6 nominal mix. The Dimension of a six inches (150 mm) block is shown in figure below:
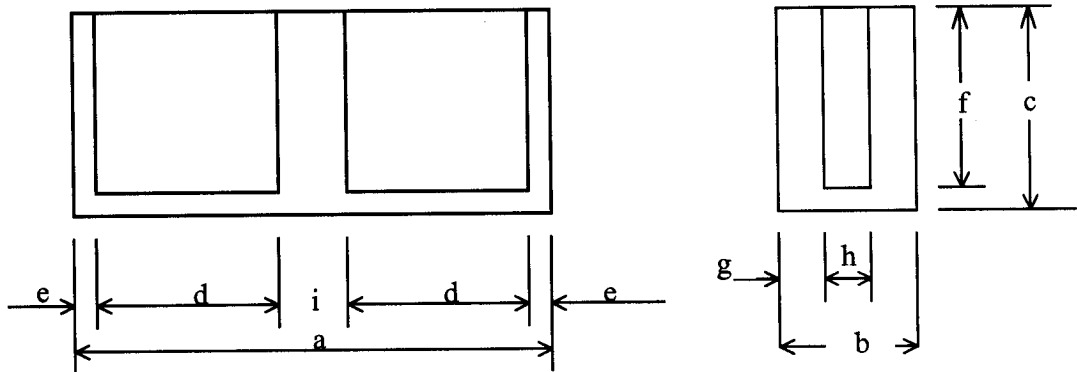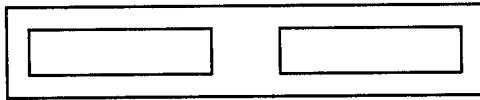
Table 1 Dimensions of the Concrete Block
Where:

Parameter	a	b	c	d	e	f	g	h	i
Size (mm)	400	150	200	100	60	160	40	70	80

a)   How many 6 inches (150 mm) concrete blocks could the farmer produce from a 50 kg bag of cement and the available aggregates, if the following assumption were valid:
Volume of 50 kg of cement = 37 litres,
Shrinkage ratio = 25%
Efficiency of building material use = 95%

(9 marks)

b)   Calculate the mass of the aggregates (sand and stones) that this farmer is going to require if the density of:
Sand = 1.45 kg/litre,
Stones = 1.60 kg/litre.

(5 marks)

c)   Determine the maximum size of the coarse aggregates.

(2 marks)

d)   How much water would you recommend to be added to the mix, explain Why?

(2 marks)

e)   Suppose the moisture content of sand is found to be 5%, while that of stones is 2%, how much water should be added to the mix to ensure that the concrete attains its maximum strength.

(6 marks)

e)   What would be:
i)   The Water – Cement ratio,
ii)   The Cement – aggregate ratio?

(2 marks)

f)   What other measures would you recommend the farmer undertake to ensure that the concrete is of the highest strength and quality?

(4 marks)

Question 2

Given an intensive Pig production unit practicing an 8-week weaning period and a one-stage finishing production, determine:

a)   The number of farrowing pens required to cater for a 15 sow-herd.

(10 marks)

b)   The number of finishing Pens if 8 weaners are to be housed in each Pen.

(10 marks)

c)   Discuss the general Site requirement for any Pig housing.

(5 marks)

d)   What other facilities can facilitate Pig production?
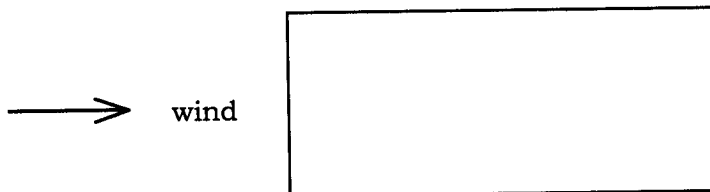
(5 marks)

SECTION B

Question 3

a)   Describe the treatment process that takes place in a Septic tank.

(5 marks)

b)   Find the septic tank dimensions required to treat wastewater from a family of 10 given that the per capital water consumption is 80 litre/person/day.

(5 marks)

c)   Calculate the desludging period if the sludge build up rate of $0.04m^3$/hd/yr.

(5 marks)

d)   Assuming an infiltration rate of 12 ltr/m^2/day, determine the size of a soakage drain required to treat the septic tank effluent.
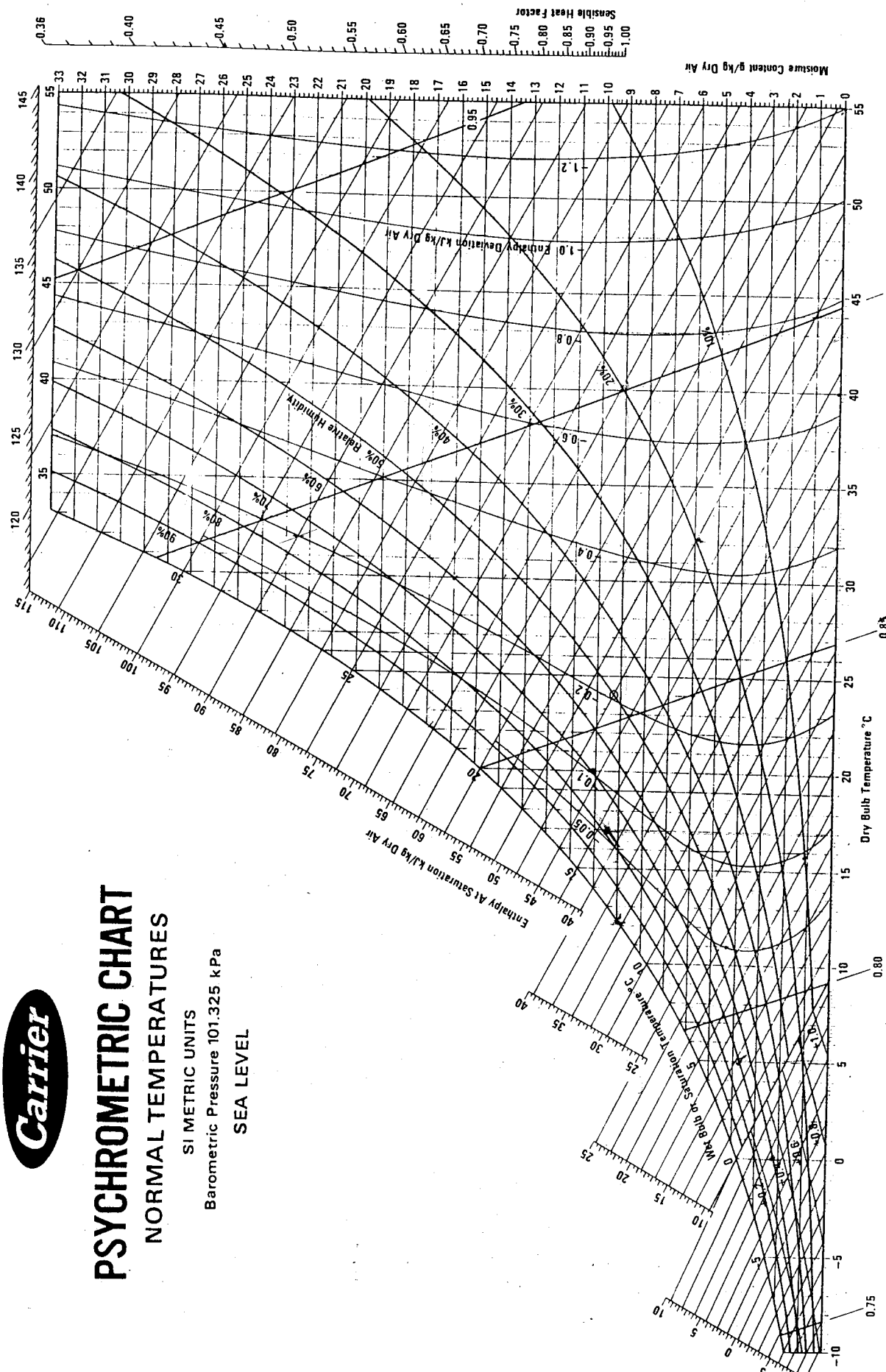
(5 marks)

Question 4

A small scale Piggery unit is to be roofed with a monopitched roof using galvanised corrugated steel sheet with the following specification:
CS 10/100 with a Width of 1000 mm and a length of 3000 mm,

a)   Describe this roofing sheet.

(3 marks)

b)   How many roofing sheets are required to roof a building with the following dimensions:
Length = 14m
Width = 8m
Slope of the roof 1:3
The end lap = 150mm
Side lap = 1 corrugation

(8 marks)

c)   Discuss the merits and demerits of the **GCSS** over the other roofing sheets.

(3 marks)

d)   Describe the procedure to follow when placing roofing sheets on the roof given the prevailing wind.

(4 marks)

⟶   wind

e)   How would you ensure a leak proof roof even after fixing the roof claddings?

(2 marks)

3

PSYCHROMETRIC CHART

NORMAL TEMPERATURES

SI METRIC UNITS

Barometric Pressure 101.325 kPa

SEA LEVEL

Carrier

Sensible Heat Factor

Moisture Content g/kg Dry Air

Enthalpy Deviation kJ/kg Dry Air

% Relative Humidity

Enthalpy At Saturation kJ/kg Dry Air

Dry Bulb Temperature °C

Wet Bulb or Saturation Temperature °C

Volume m³/kg Dry Air

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

Question 5

At one of the Commercial farmer's crop storage warehouse, grain was being dried using heated air flowing at 0.75 m³/s. The air was initially heated from 10 °C to 35 °C. The initial relative humidity of the air was 60%. Using the Psychrometric chart:-

a)   Calculate the amount of sensible heat required to heat the air,

(6 marks)

b)   What would be the relative humidity at the end of the heating process?

(2 marks)

c)   Quantify the moisture removed from the grain at the end of the drying process, if the RH rose to 90%.

(4 marks)

d)   With the aid of a sketch discuss sensible heating and cooling listing some examples.

(8 marks)

END OF EXAMS

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

1st SEMESTER EXAM -
COURSE:UNIT OPERATIONS IN FOOD ENFINEERING II -GF 511
DATE 11TH AUGUST 2003
TIME: 8;00-11HOURS

INSTRUCTION:
HANDOUTS AND OTHER STUDY NOTES ARE ALLOWED AS WELL AS
TABLES AND CONVERSION TABLES - NO SOLVED EXERCICES
ALLOWED. CLEARLY SHOW ALL THE STEPS LEADING TO THE
SOLUTION. GIVE ADDITIONAL EXPLANATIONS OR COMMENTS IF
NECESSARY.

1. A 30 by 30 in plate-and-frame filter press with twenty frames 2.50 in thick is to be used to filter $CaCO_3$ slurry. The effective filtering area per frame is 9.4 ft². If filtration is carried out at constant pressure with (- P) = 40 psi, determine the volume of slurry that will be handled until the frames are full, and the time required for this filtration. The slurry contains 0.0723 weight fraction of $CaCO_3$, the density of the dried cake is 100lb/ft³, $\alpha = 2.41 \times 10^{11}$ ft/lb, $\mu = 5.95 \times 10^{-4}$ lb/ft-s, or $\rho_{CaCO3} = 183$ lb/ft³ $\rho_{H2O} = 62.4$ lb/ft³.
   Nota: Slurry density should be calculated using the weight fraction of $CaCO_3$ taking into account that it is a mixture of solid and water. (30pts)

2. In a centrifuge separating oil (of density 900kgm^{-3}) from brine (of density 1070 kgm^{-3}) the discharge radius for the oil is 5 cm. Calculate a suitable for the brine discharge and for the feed intake so that the machine will work smoothly assuming that the volume of oil and brine are approximately equal. (20pts)

3. A sieve analysis gives the following results:

Sieve size mm	Weight retained g
1.0	0
0.500	64
0.250	324
0.125	240
0.063	48
Through 0.063	24

Plot a cumulative size analysis and a size distribution analysis, and estimate the weights per 1000kg of powder, which would be lie in the size range 0.150 to 0.200 mm and 0.250 to 0.350 mm. (10 pts)

4. Air carrying particles of density 1800kgm-3 and average diameter of 20μm enters a cyclone at a linear velocity of 18m/s. The diameter of the cyclone is 600mm.
   a. What is the approximate separation factor for this cyclone?
   b. What fraction of the particles would be removed from the gas stream? (20pts)

5. If a centrifuge is regarded as similar to a gravity settler but with gravity replaced by the centrifugal field, calculate the area of a centrifuge of working radius r and speed of rotation N revolutions m^{-1} which would have the same throughput as a gravity tank of area 100m². (20 pts).