

UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2014 / 2015 MID YEAR EXAMINATION

1. AGA 3201 Principles of Animal nutrition
2. AGA 335 Principles of Animal production
3. AGA 4311 Principles of genetics
4. AGA 4511 Beef, Sheep, Goat and Rabbit production
5. AGA 5121 Advances in Animal nutrition
6. AGA 5321 Applied Animal reproduction
7. AGC 3121 Crop production
8. AGC 5331 Principles of weed management
9. AGC 5421 Advanced horticulture
10. AGE 2111 Fundamentals of Micro-Economics
11. AGE 3381 Research methodology
12. AGE 4131 Production Economics
13. AGE 4211 Introduction to agribusiness management
14. AGE 5151 International agricultural markets, trade and development
15. AGE 5251 Agricultural project planning and appraisal
16. AGF 2015 Fundamentals of organic chemistry
17. AGF 2401 Introduction to technology and communication
18. AGF 3021 Chemical techniques in food analysis- theory
19. AGF 3021 Chemical techniques in food analysis- practical
20. AGF 3031 Food chemistry theory

21. AGF 3031 Food chemistry practical
22. AGF 3201 Technical thermodynamics
22. AGF 4065 Nutrition
23. AGF 4221 Process control and instrumentation
24. AGF 5071 Food colloids
25. AGF 5241 Plant design and environmental management
26. AGF 5321 Technology of dairy and egg production
27. AGF 5615 Processing and preservation of plant products
28. AGG 3811 Rural sociology
29. AGN 3311 Nutrition assessment
30. AGN 4241 Nutrition disorder
31. AGN 4321 Research methods and epidemiology for nutritionists
32. AGN 5421 Food services systems management
33. AGS 3711 Agro climatology
34. AGS 4221 Soil and plant analysis
35. AGS 5121 Soil genesis and classifications
36. AGS 5131 Soil survey and GIS techniques
37. AGS 5411 Soil microbiology
38. AGS 5511 Agriculture hydraulics and irrigation development



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

2014 Academic Year Mid-Year Examinations
Course: AGA 3201 – Principles of Animal Nutrition

Date: 3rd March 2015 **Time:** 09 00 Hours

INSTRUCTIONS: Answer any five (5) questions; they all carry 20 equal marks.

1. The gastro intestinal tract (GIT) of animals is made up of digestive organs that perform specific functions for digestion and absorption of nutrients. Associated with these are the accessory organs. Name and explain the functions of the different accessory organs that facilitate the digestion, absorption and subsequent utilization of nutrients in non-ruminants **(20 Marks)**?
2. A). What are the main sources of dietary energy for non-ruminants in the **tropics (4 Marks)**?
B). What are the end products of carbohydrates digestion and how are they metabolized after being absorbed from the digestive system through glycolysis and the Tri-carboxylic (TCA) cycles **(12 Marks)**?
C). What are the end products of the TCA and how are they utilized by the animal **(4 Marks)**?
3. A). Ruminants depend on rumen microbial fermentation for utilization of fibrous feed materials, and yet modern high producing ruminants need additional nutrients for increased productivity. Explain how you would manipulate the rumen eco-system to maximize microbial activities and at the same time increasing the supply of nutrients to the host animal **(14 Marks)**?
B). What are some of the advantages and disadvantages of rumen microbial fermentation in ruminants in comparison with gastric digestion in non-ruminants **(6 Marks)**?

4. A.) What are the key metabolites/nutrients available for metabolism in ruminants after they have undergone microbial fermentation, digestion and absorption of nutrients in the lower GIT and how are these metabolites utilized by the host animal **(12 Marks)**?
B). What are the end products of rumen microbial fermentation and how are they mobilized from the rumen system **(8 Marks)**?
5. A). Protein is one of the main nutrients limiting productivity of ruminants during the dry season. Explain how you would ensure your animals have adequate supply of proteins for increased rumen microbial fermentation and true protein supply for increased production of the host animal **(14 Marks)**?
B). In resolving the stated problems in A, what are some of the dangers that one has to be aware of and what steps would you need to undertake to minimize them **(6 Marks)**?
6. A). Explain the importance of blending and heat processing in the preparation of animal feeds for non-ruminants **(8 Marks)**?
B). What are some of the feed contaminants that may affect the quality of feeds or ingredients during harvesting, storage and/or transportation and how would you minimize such contaminations to ensure feed quality **(12 Marks)**?

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THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF ANIMAL SCIENCE
FINAL EXAMINATIONS : FIRST HALF-YEAR 2014/15
COURSE: AGA 3335-PRINCIPLES OF ANIMAL PRODUCTION
DURATION: THREE (3) HOURS

Instructions:

- Answer each section in a separate answer booklet
- Carefully read instructions for each section
- Begin each question on a new page, and,
- Indicate the number of each question attempted
- Answer any five questions in all

SECTION A – ANATOMY AND PHYSIOLOGY

QUESTION ONE

- (a) What are the types of digestive systems found in domestic animals? [6]
- (b) Draw and clearly label one of the systems in question (a) above. [10]
- (c) Describe four adaptations of the respiratory system that enable it to perform its functions? [4]

QUESTION TWO

With regard to domestic animals;

- (a) What is rumination? [2]
- (b) Given the formula $DF = 2 \left[I \frac{0}{4} + C \frac{0}{0} + P \frac{3}{3} + M \frac{3}{3} \right] = DF$
- (i) What is this formula called? [2]
- (ii) What do each of the letters and numbers represent? [13]
- (iii) What is the value of DF? [1]
- (iv) What type of animal would this formula be representing? [1]
- (v) State the function of the members of the stated formula. [1]

QUESTION THREE

With regard to Animal Production;

- (i) Use a well labeled diagram to show the parts of the female reproductive system. [10]
- (ii) State the reproductive organs considered accessory to male animals. [4]
- (iii) Name two types of uteri found in domestic animals? [2]



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- (iv) What are the sites of and the functions of the reproductive system?

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SECTION B – ANIMAL HUSBANDY

QUESTION FOUR

- (a) A retired company executive has approached you for advice regarding which livestock farming business is better to invest his retirement money in. Explain with seven reasons, why he is better off investing his money in broiler farming than other farm livestock [14]
- (b) Explain at least three distinguishing characteristics between a egg laying and meat breeds of chickens [6]

QUESTION FIVE

- (i) In Zambia, it is recommended that beef cows/heifers should be serviced between 15th December and 31st March. Explain at least five advantages associated with bulling the cows/heifers during this period. [10]
- (ii) Give three reasons why beef/dairy heifers coming on heat for the first time during any bulling season should not be serviced by the bull or A.I. [6]
- (iii) What are the two distinguishing characteristics between the Angoni and Tonga breeds reared in Zambia? [4]

QUESTION SIX

A farmer intends to rear 2, 500 Cobb 500 broilers. According to the feed manufacturer, broilers should be fed two types of starter feeds; Starter 1 (0-14 days of age) and Starter 2 (14-21 days of age). Thereafter, they can be fed finisher feed until 42 days of age. The feed consumption of Cobb 500 broiler chickens, as recommended by the breeder, is as outlined in the guide provided to you.

Calculate the following;

- (i) Number of 50 kg bags of Starter 1 feed required [4]
- (ii) Number of 50kg bags of Starter 2 feed required [4]
- (iii) Number of 50kg bags of Finisher feed required [4]
- (iv) The total area required if the recommended stocking density is 10 birds/m² [4]
- (v) Total amount of money required to feed them from hatch up to 42 days of age if the cost of feed is K3.36 per Kg of starter 1, K3.20 per Kg of starter 2, and K3.04 per Kg of finisher feed. [4]

END OF EXAMINATION – GOOD LUCK – BOONE CHANCE!

- (iv) What are the sites of and the functions of the reproductive system?

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Cobb500 Broiler Performance & Nutrition Supplement

Performance objectives - metric

AS HATCHED						
Age days	Weight for Age	Daily Gain (g)	Average Daily Gain (g)	Cumulative Feed Conversion	Daily Feed Consumption (g)	Cumulative Feed Consumption (g)
0	42					
1	52	10				
2	66	14				
3	81	15				
4	100	19				
5	122	22				
6	148	26				
7	177	29	25.3	0.847		150
8	208	31	26.0	0.865	30	180
9	242	34	26.9	0.888	35	215
10	279	37	27.9	0.914	40	255
11	320	41	29.1	0.938	45	300
12	364	44	30.3	0.962	50	350
13	410	46	31.5	0.988	55	405
14	459	49	32.8	1.013	60	465
15	511	52	34.1	1.039	66	531
16	567	56	35.4	1.063	72	603
17	626	59	36.8	1.088	78	681
18	688	62	38.2	1.112	84	765
19	753	65	39.6	1.135	90	855
20	821	68	41.1	1.158	96	951
21	891	70	42.4	1.182	102	1053
22	964	73	43.8	1.205	109	1162
23	1039	75	45.2	1.230	116	1278
24	1115	76	46.5	1.257	123	1401
25	1193	78	47.7	1.283	130	1531
26	1272	79	48.9	1.311	137	1668
27	1353	81	50.1	1.339	144	1812
28	1436	83	51.3	1.367	151	1963
29	1521	85	52.4	1.394	158	2121
30	1608	87	53.6	1.422	165	2286
31	1697	89	54.7	1.448	172	2458
32	1788	91	55.9	1.475	179	2637
33	1880	92	57.0	1.502	186	2823
34	1973	93	58.0	1.529	193	3016
35	2067	94	59.1	1.556	200	3216
36	2162	95	60.1	1.581	202	3418
37	2257	95	61.0	1.604	203	3621
38	2352	95	61.9	1.627	205	3826
39	2447	95	62.7	1.648	206	4032
40	2542	95	63.6	1.668	208	4240
41	2637	95	64.3	1.687	209	4449
42	2732	95	65.0	1.705	210	4659
43	2826	94	65.7	1.724	212	4871
44	2919	93	66.3	1.742	214	5085
45	3011	92	66.9	1.761	216	5301
46	3102	91	67.4	1.779	218	5519
47	3192	90	67.9	1.798	220	5739
48	3281	89	68.4	1.817	222	5961
49	3369	88	68.8	1.836	224	6185
50	3456	87	69.1	1.855	225	6410
51	3542	86	69.5	1.874	226	6636
52	3627	85	69.8	1.892	226	6862
53	3711	84	70.0	1.910	227	7089
54	3794	83	70.3	1.928	227	7316
55	3876	82	70.5	1.946	228	7544
56	3958	82	70.7	1.964	228	7772



THE UNIVERSITY OF ZAMBIA

THE SCHOOL OF AGRICULTURAL SCIENCES

2014/15 ACADEMIC YEAR – FIRST HALF EXAMINATIONS

COURSE AGA 4311 – PRINCIPLES OF GENETICS

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

- Answer Question one (1) and any four (4) others.
- All Questions carry equal marks (20).
- Clearly show all the calculations.

Q. 1 a. In 1908 Hardy and Weinberg developed a law in genetics called Hardy-Weinberg Law. State the law and deduce it (show that it is true).

b. The following blood group data was collected from goats in Katete:

Genotype	Observed
AA	366
AB	220
BB	34

Determine whether this population is in Hardy-Weinberg equilibrium.

- What would be the change in gene frequency of B after one generation of not allowing genotype BB to contribute any gametes in the population stated in Q. 1 b.?
- If a proportion of 20% of goats joined the Katete goats in Q. 1 b. and the gene frequency of A among these immigrants is 0.3, what would be the new gene frequency of A and how much will be the increase or decrease of gene frequency of B.

Q. 2 Explain the nature of the genetic code and the processes which enable the sequence of nitrogenous bases in DNA to give rise to the sequence of amino acids in a protein.

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

- The test cross and its uses;
- Sex determination and linkage;
- Co-dominance and multiple allelism; and
- Cause of sterility following the mating of closely related species.



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- Q. 4 a. Explain the sequence of events that take place during Prophase I of Meiosis and indicate their genetic consequences.
- b. In garden peas, yellow pods is recessive to green pods, bluish green seedlings are recessive to green seedlings and creeper plant (cannot stand up) is recessive to normal plant. A true breeding normal plant with green pods and green seedlings was crossed to a creeper with yellow pods and bluish green seedlings. The F_1 plants were then crossed to creepers with yellow pods and bluish seedlings. The following results were obtained:

2 059	Green pods, green seedlings, normal
151	Green pods, green seedlings, creeper
281	Green pods, bluish green seedlings, normal
15	Green pods, bluish green seedlings, creeper
2 041	Yellow pods, bluish green seedlings, creeper
157	Yellow pods, bluish green seedlings, normal
282	Yellow pods, green seedlings, creeper
11	Yellow pods, green seedlings, normal

What is the sequence of these linked genes in their chromosome? Calculate the map distance between the genes and the Coefficient of Coincidence.

- Q. 5 a. In *Drosophila*, a gene that causes vestigial wings is 12.5 map units from the gene that causes purple eyes. A third gene that causes black body colour is 18.5 map units from the gene that causes vestigial wings and 6 map units from the gene that causes purple eyes. The alleles that cause vestigial wings, purple eyes and black body colour are all recessive. The dominant or wild type traits are long wings, red eyes and gray body colour. A researcher crossed the wild type flies to flies with vestigial wings, purple eyes and black body colour. All the F_1 flies were wild type. The researcher then crossed the F_1 female flies to male flies with vestigial wings, purple eyes and black body colour. If a total of 1, 000 progeny were observed, what are the expected numbers with the following types of flies?

Long wings, red eyes, gray body;
 Long wings, purple eyes, gray body;
 Long wings, red eyes, black body;
 Long wings, purple eyes, black body;
 Vestigial wings, red eyes, gray body;
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- b. Write notes on Chromosomal and Point Mutations.

- Q. 6 With the aid of examples, explain what is meant by the Laws of Segregation and Independent Assortment. Under what conditions do the Laws not hold? What are the expected ratios in the F_2 generations when one of the two genes are segregating and behaving independently.

END OF EXAMINATION

- Q. 4 a. Explain the sequence of events that take place during Prophase I of Meiosis and indicate their genetic consequences.
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2014/15 ACADEMIC YEAR – FIRST HALF EXAMINATIONS

COURSE AGA 4311 – PRINCIPLES OF GENETICS

TIME ALLOWED: THREE (3) HOURS ONLY

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- Q. 2 Explain the nature of the genetic code and the processes which enable the sequence of nitrogenous bases in DNA to give rise to the sequence of amino acids in a protein.
- Q. 3 With the aid of examples, write notes on the following:
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2014/15 ACADEMIC YEAR – FIRST HALF EXAMINATIONS

COURSE AGA 4511 – Beef, Sheep, Goats and Rabbit Production

TIME ALLOWED: THREE (3) HOURS ONLY

INSTRUCTIONS TO CANDIDATES:

- a. All Questions carry equal marks (20).
 - b. Answer any **two (2)** questions from Section A and any **three (3)** others.
 - c. Use different answer books for each Section.
-

SECTION A – Beef Production

- Q. 1 Outline and explain all the routine management practices that should be carried in a beef herd of your choice in order to ensure good performance.
- Q. 2 Zambia's ability to capture the potential economic benefits of expanded beef industry is constrained by gaps in productivity and price competitiveness. The beef industry in Zambia has great potential to becoming a major foreign exchange contributor to the national treasury.
- a. Give reasons as to why the beef industry has great potential for growth in Zambia (5 marks).
 - b. What would it take for the industry to achieve its potential (5 marks)?
 - c. Zambia is endowed with a several indigenous cattle species that provide a wide range of social and economic importance in the lives of the local people. In recent years, survival threats for the local breeds have been on the increase:
 - i. Outline the importance of the local cattle breeds in the beef industry in Zambia (3 marks).
 - ii. What are the major threats to the survival of the local cattle breeds in Zambia? (4marks).

- iii. What are the benefits of inclusion of exotic cattle breeds in the beef industry in Zambia? (3 marks).

Q. 3 In 2012 a farmer in Kalomo bought 3 Tonga bulls, 6 oxen and 55 Angoni cows, 15 Boran cows and 5 Boran heifers. On 17th December 2012 the bulls and cows were brought together for breeding and were separated on 14th March 2013. The number of calves born comprised 30 males and 35 females. On 1st June 2014, 63 calves were weaned. Comment on the performance of the farm based on the following parameters (please show the calculations where necessary to support your answer):

- a. The breeding ratio;
- b. The breeding system;
- c. The calving percentage;
- d. The Breeding season; and
- e. The weaning percentage.

SECTION B – Sheep and Goat Production

Q.4 Write notes on the following:

- a. The advantages of rearing sheep and goats in Zambia as compared to other types of livestock; and
- b. The factors that should be taken into consideration in the selection of sheep and goat breeding stock.

Q. 5 Having been recently appointed as the Farm Manager of an intensive sheep and goat enterprise at UNZA's Liempe Farm, discuss any ten (10) lamb and kid routine management practices that you would put in place to ensure that the farm operates profitably.

SECTION C – Rabbit Production

Q. 6 As a recent graduate from the University of Zambia, you have been appointed a Farm Manager at a mixed farm that includes a Rabbit Unit. With your knowledge that a good breeding routine:

- a. Design a rabbit hutch breeding record (10 Marks); and

- b. The factors that should be taken into consideration when selecting rabbit breeding stock (10 Marks).

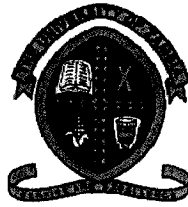
- Q. 7. The Extension Service Department of the Ministry of Agriculture and Livestock (MAL) has been tasked by the Government of the Republic of Zambia (GRZ) to promote rabbit production in the country. As a Rabbit Production Expert stationed in Lusaka District, discuss any ten (10) reasons/advantages of rabbit production over other forms livestock production to convince interested would-be rabbit producers to establish rabbit production units.

END OF EXAMINATION

- b. The factors that should be taken into consideration when selecting rabbit breeding stock (10 Marks).

- Q. 7 The Extension Service Department of the Ministry of Agriculture and Livestock (MAL) has been tasked by the Government of the Republic of Zambia (GRZ) to promote rabbit production in the country. As a Rabbit Production Expert stationed in Lusaka District, discuss any ten (10) reasons/advantages of rabbit production over other forms livestock production to convince interested would-be rabbit producers to establish rabbit production units.

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA
THE SCHOOL OF AGRICULTURAL SCIENCES

2014/15 Academic Year – Mid-year Examinations

Course AGA 5121 – Advances in Animal Nutrition

Date: Monday 23rd February 2015

Time Allowed: Three (3) Hours Only

Instructions to Candidates:

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

SECTION A (RUMINANT NUTRITION):

- Q. 1** With the help of the Pearson Square, formulate a ration for beef cattle containing 14% DCP and 75% TDN which must include 12% mixture of Natural Grass/Stylo Hay, 10% Maize Bran, 5% Sugarcane Molasses, 10% Soyabean Straw, 1% Salt and 2% slack space for mineral supplement, on dry matter basis. The table below may be used to answer the question:

Feed analyses (on dry matter basis, i.e. moisture free) are:

FEED	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

The other available feedstuffs are:

Maize meal	89	10.0	88	0.03	0.31
Groundnut meal	95	55.0	90	0.18	3.62
Groundnut haulms	87	12.0	62	0.07	0.17
Lucerne hay	90	85.0	60	0.27	0.03

(20 Marks)

- Q. 2** a. How much concentrate mixture consisting of 30% Maize Meal, 30% Cottonseed Cake, 30% Cassava Meal and 10% Cane Molasses should be fed to provide sufficient energy to maintain a 550 kg empty Friesian cow that is losing 0.5 kg body weight per day two

weeks post-partum that is consuming 20 kg/day Maize Silage and produces 20 kg/day milk containing 3.8% butterfat (BF) and 8.6% solids-not-fat (SNF) per kg?

The following may be used to answer the question:

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

- b. What is the anticipated milk yield of the cow above at peak milk production?
- c. If the Jersey cow in Q. 1 a. above was actually in mid-lactation and there was no live-weight change in her body weight, how much concentrate mixture should she be fed?
- d. If the Jersey cow in Q. 1 a. above was actually in late lactation and was gaining 0.25 kg per day, how much concentrate mixture should she be fed?
- e. Using the Rapid Formulation Method calculate the forage and concentrate dry matter intake of the Friesian cow in Q. 1 a. and 1 d. above?

(20 Marks)

Q. 3 Write notes on the following:

- a. How much is a Boran steer weighing 305 kg expected to grow if it is fed on a daily ration consisting of the following feed-stuffs:

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

- b. The functions of micro-organisms in the ruminant stomach and the benefits enjoyed by the ruminant animal as a result of microbial action.

(20 Marks)

SECTION B (NON-RUMINANT NUTRITION):

- Q. 4**
 - a. Explain what you understand by the term metabolisable energy as it applied to determination of energy utilized by poultry species including chickens (3 Marks)?
 - b. How does it differ from that of digestible energy as it applies to pigs (2 marks)?
 - c. Explain in detail how you would go about in determining the amount of metabolisable energy in chickens (10 Marks)?
 - d. What would be the importance and how would you correct the calculated values for endogenous and nitrogen excretions (5 Marks)?

(20 Marks)

- Q. 5 a.** What are some of the recent advances or developments at National and International levels as far as feeding of non-ruminants and ruminants is concerned? (12 Marks)?
- b.** What are the driving forces or determining factors that are responsible for these developments (8 Marks)?

(20 Marks)

- Q. 6 a.** Explain the importance of feed processing and blending as far as feeding of farm animals is concerned (8 Marks)?
- b.** What are some of the major endogenous anti-nutritional factors found in feeds of non-ruminants and how can their effects be minimized (12 Marks)?

(20 Marks)

END OF EXAMINATION

The following may be used to answer the questions:

- i. $MI = \frac{EVI \times 1.05}{0.62}$
- ii. $Kg = 0.0435 M/D$
- iii. $MEP = MER - Mm$
- iv. $Mm = 8.3 + 0.091 W$
- v. $FD = \frac{DMI (MC - M/D)}{(MC - MF)}$
- vi. $DMI = 0.025 W + 0.1 Y$
- vii. $Eg = \frac{MEP \times 0.0435 M/D}{1.05}$
- viii. $Eg = MEP \times 0.0414 M/D$
- ix. $DMI = 0.025 W + 0.1 Y - 2.5$
- x. $LWG = \frac{Eg}{6.28 + 0.3 Eg + 0.0188 W}$
- xi. $KI = \frac{0.0435 M/D}{1.05}$ or $0.0414 M/D$
- xii. $EVI = 0.0386 BF + 0.0205 SNF - 0.236$



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

**FINAL EXAMINATIONS: FIRST HALF-YEAR 2014/15
COURSE: AGA 5321 APPLIED ANIMAL REPRODUCTION
DURATION: THREE (3) HOURS**

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

SECTION A

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

QUESTION ONE

- A) What is the purpose of the following products or terms in animal reproduction? [20]
- | | |
|-----------------------|----------------|
| i. Follicular waves | iv. Estrumate® |
| ii. Acrosome reaction | v. CIDR® |
| iii. Cryptorchidism | |
- B) Profitable animal production enterprises rely on successful reproduction.
- i. State four factors that impact negatively on animal reproduction? [5]
 - ii. How can each of the factors named in B) i. above be resolved? [5]

QUESTION TWO

- A) With the aid of a diagram describe the segments and role of the segments of a spermatozoon. [9]
- B) Briefly describe three ways in which the foetus may regulate the timing of parturition. [6]
- C) Discuss three factors that contribute towards lowering reproductive efficiency of farm animals. What assisted reproductive technique (1) would you use to resolve each of these? [15]



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QUESTION THREE

A) With regard to Animal biotechnology;

- i. What are transgenic animals? How does this process differ from embryo splitting. [4]
- ii. Describe the deficiencies in nature that MOET seek to resolve. [5]
- iii. What is meant by and what is the benefit of semen and embryo sexing? [4]
- iv. What is the basis of a laboratory test for pregnancy? [2]

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

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

SECTION B

INSTRUCTIONS: ANSWER BOTH QUESTIONS IN THIS SECTION

QUESTION ONE

(20)

- a). Choose one livestock specie and describe one method you would use to collect semen from the male animal. What are the benefits of using your chosen method of semen collection.
- b). Discuss the methods that you can use to evaluate the semen before deciding whether it is of good quality or not.
- c). How should semen be processed and stored for latter used.

QUESTION TWO

The capacity of an animal to produce and reproduce differs between species, breeds and strains as a result of genetic factors. However, a complex set of interrelated animal husbandry factors will influence the animal's ability to utilize that capacity for growth, development and production and reproduction. Mention and explain how the different environmental factors affect reproduction in farm animals. (20)

END OF EXAMINATION – GOOD LUCK – BOONE CHANCE

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UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF PLANT SCIENCE
Third Year Examinations for Bachelor of Agricultural Sciences
AGC 3121 CROP PRODUCTION
Final Examination, 2014/2015 Academic Year

Date: 26th February 2015

Time: 9:00 – 12:00 hrs

Venue: OMNIA 1&2

Instructions: Answer all Questions.

Marks are as indicated.

Answer each section in a separate booklet.

SECTION A

1. Indicate whether True (T) or False (F)

- a. In shelled Groundnuts, aflatoxins are produced by a fungus, *Aspergillus flavins*.
- b. In Sinazongwe district, the Maize varieties recommended for growing are the 700 series.
- c. The safe moisture content for storage in Beans is 12 %.
- d. The picking/harvesting interval in Cotton is one (1) week.
- e. In Sweet Potato production, the vines used for planting are 20-30 cm in length with 7-10 nodes.

(2.5 marks)

2. A group of Youths in the Lukanga Swamps would like to grow Rice for the first time. As an Agricultural Officer in the area, what would be your advice on the following:

- a. Land preparation. **(5 marks)**
- b. Methods of planting. **(8 marks)**

3. As a Cotton Entomologist, you have been requested to give a presentation on bollworms to 3rd Year Natural Resources Development College (NRDC) students taking an Organic Agriculture course. What would you include in your presentation? **(10 marks)**

SECTION B

1.
 - a. Name the criteria used to differentiate between micro and macro nutrients in plants. (6 marks)
 - b. Identify all micro and macro nutrients required for normal plant growth. (7.5 marks)
 - c. Explain three (3) strategies to enhance the availability of both micro and macro nutrients in plants. (6 marks)
 - d. List three (3) symptoms each of Phosphorous and Calcium deficiency in plants. (6 marks)
2.
 - a. Explain the factors that influence light conversion efficiency in crop production. (5 marks)
 - b. Assume the following conditions for a given crop of baby corn:

$$T_b = 8^{\circ}\text{C}$$

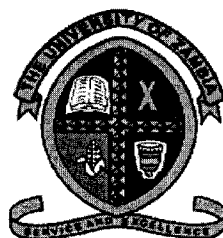
$$\text{Average daily temperature} = 28^{\circ}\text{C}$$

$$\text{Thermal Time} = 3,280^{\circ}\text{C days}$$

If the above maize crop of baby corn was planted on 1st December 2014, estimate the following:

- i. Maturity duration of the baby corn. (3 marks)
- ii. Date when baby corn would be ready for harvest. (1 mark)

End of Examination



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
Department of Plant Science

Final Examination for the first half of the 2014/2015 academic year

Course name: Principles of Weed Management
Course code: AGC5331
Date: Thursday 27th February, 2015
Time allowed: Three hours 09:00 – 12:00 hours
Venue: Omnia 1 Lecture Theatre

INSTRUCTIONS:

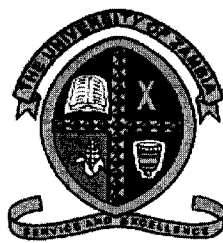
There are two sections to this examination. Section I is compulsory and all the questions should be answered. Section II is optional. Three questions are provided but answer only two. Points for each question are indicated.

SECTION I (COMPULSORY)

Q1 (30 points)

- a) Why are weeds the most underestimated pest of tropical agriculture?
- b) What are the differences and similarities between triazines and carbamates? Give concrete examples of herbicides that fall under each family?
- c) What is the difference between true and functional allelopathy? Discuss the application of allelopathy using benzocyclohexanediones as an example that has revolutionized this phenomenon.
- d) List ten different weed species by scientific name from ten different families found in the Field Station; i.e.

Serial number	Weed by scientific name	Family
1.		
2.		



**THE UNIVERSITY OF ZAMBIA
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Serial number	Weed by scientific name	Family
1.		
2.		

SECTION II (OPTIONAL)

Q2. (15 points)

- a) Discuss, with the aid of a diagram, the possible fate of a herbicide once it is applied to the soil.
- b) Define weed control, weed eradication and weed management.

Q3 (15 points)

- a) Discuss parasitism from a crop-weed interaction perspective, describing the different types of parasitic weeds (with examples) and possible control measures for them.
- b) List out five different herbicide formulations giving an example of a herbicide that is under each listed formulation.

Q4 (15 points)

- a) What differentiates biological weed control from cultural weed control? List five measures that comprise each control type.
- b) Enumerate five beneficial effects of weeds giving an example of a weed that falls under each effect!

End of Examination



UNIVERSITY OF ZAMBIA

School of Agricultural Sciences

DEPARTMENT OF PLANT SCIENCES

B. Agric. Sci. Programme- Second term.

AGC 5421: ADVANCED HORTICULTURE FINAL EXAMINATION

Date. 23rd February 2015

Time 14:00 to 17:00 hrs

INSTRUCTIONS

Answer ANY 4 (FOUR) questions.

Time: Three (3) hrs

-
1. You have been asked to develop an extension bulletin for farmers. In the manual describe commercial production of oranges (*Citrus sinensis*), including in your answer the following;
 - i. Ecological requirements
 - ii. Planting materials and planting methods
 - iii. Varieties
 - iv. Pest and diseases.
 2. Landscaping is becoming an integral part of human settlements. Describe the following
 - 2.1. What landscaping is, its importance and
 - 2.2. Five key features of a country (or rural) garden.
 3. Describe the cellular and whole plant effects of cytokinins **AND** abscissic acid.
 4. Relative to photosynthesis describe the following
 - 4.1. What are the key factors that determine carboxylation efficiency and
 - 4.2. How they can be manipulated at a practical level to enhance plant productivity.



UNIVERSITY OF ZAMBIA

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5. Describe different types of budding and cuttings systems used in plant propagation. Include in your answer the commodities for each method and the type of growth regulators used where applicable.

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
MID-YEAR EXAMINATION FOR 2014/15 ACADEMIC YEAR

AGE 2111: FUNDAMENTALS OF MICRO-ECONOMICS

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL FIVE QUESTIONS

QUESTION 1

(a)

- i. What is economics? (2 marks)
- ii. What is the fundamental economic problem? (2 marks)
- iii. What is opportunity cost? (2 marks)
- iv. Explain the difference between normative and positive economics. (2 marks)

(b)

- i. Explain the difference between change in demand and change in quantity demanded. (2 marks)
- ii. What is the law of demand? (2 marks)
- iii. What are the determinants of demand? (2 marks)
- iv. Explain what you understand by the law of diminishing marginal utility. (2 marks)

(c) What is the utility maximizing rule? (4 marks)

QUESTION 2

(a)

- i. What is an indifferent curve? What are its characteristics? (2 marks)
- ii. Illustrate with the aid of a diagram an indifferent map. (2 marks)
- iii. What is a budget constraint? (2 marks)

- iv. Show how to derive the demand curve using indifference curve analysis. (2 marks)
- (b) What is the major difference between using the mid-point formula and point formula when calculating elasticities. Explain when you could use each of the formulas. (4 marks)
- (c) Assume that the average price of a new car is K 7,000 and that a million cars are sold at this price each year. If the price elasticity of demand for new cars is 1.5, what will be the effect on yearly sales if the average price of a new car declines to K 6,930? (4 marks)
- (d) Show with the aid of diagrams:
 - i. Effect of change in income on the budget constraint. (2 marks)
 - ii. Effect of changes in price on the budget constraint. (2 marks)

QUESTION 3

- (a) Show as clearly as possible the substitution effect, income effect and total effect of a normal good. (4 marks)
- (b)
 - i. What is an isoquant? (2 marks)
 - ii. Using isoquants and isocost lines show the least cost combination of output for labour and capital. (4 marks)
 - iii. With the aid of a diagram, show the three stages of the production function. Show the stage of decreasing marginal product, decreasing average product and of negative marginal product. Which stage or region would the firm operate? (5 marks)
- (c) What is price discrimination? Explain how a monopolist might practice third degree price discrimination. What are the conditions required for third degree price discrimination to succeed? (5 marks)

QUESTION 4

- (a) Do you agree or disagree with each of the following statements? Explain your reasons.
 - i. For a competitive firm facing a market price above average total cost, the existence of economic profits means the firm should increase output in the short-run even if price is below marginal cost. (4 marks)
 - ii. If marginal cost is rising with increasing output, average cost must also be rising. (4 marks)
 - iii. Fixed cost is constant at every level of output except zero. When a firm produces no output, fixed costs are zero in the short-run. (4 marks)

- (b) Explain why a perfectly competitive firm might continue to produce and sell its product in the short-run, even though the average revenue it received was less than its short-run average total cost. (8 marks)

QUESTION 5

- (a) The kinked demand curve describes price rigidity. Explain how the model works. Why does price rigidity arise in oligopolistic markets? (5 marks)
- (b) Suppose the demand function is $Q_d = 28 - 2P$ and the supply function is $Q_s = 4 + 4P$ where P is the price of maize in kwacha per Kg, and Q is the quantity in millions of tons. Find the free market equilibrium price and quantity. (5 marks)
- (c) Why is it only in the long-run that perfect competition yields an optimum allocation of resources? What happens in the short-run term? (5 marks)
- (d) List the conditions required for perfect competition. (5 marks)

The University of Zambia
School of Agricultural Sciences
University First Half Examinations – March 2015

AGE 3381
Research methodology

Time: Three (3) hours

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

1. Research is defined as “a systematic approach to obtaining new & reliable Knowledge” (Ethridge, 1995). The research plan is said to be the key to successful research and the research proposal to be the heart of the research plan. Answer the following questions. {15 points}
 - a) Knowledge is acquired in many ways. List the six ways discussed in class and, for each, state whether it leads to private or public knowledge. [6 points]
 - b) Which of the sources referred to in ~~1)~~ is essential for deriving knowledge of relationships? Explain. [2 points]
 - c) Objectivity is the lifeblood of reliable knowledge. Explain. [2 points]
 - d) List the purpose(s) that the research proposal serves. [2 points]
 - e) Why is the quality of sampling important in survey research? [3 points]

2. Research has several characteristics and classifications. Answer the following questions about research. {15 points}
 - a) List and explain the six research characteristics discussed in class. [6 points]
 - b) As a process, research is said to demand some level of creativity. List four of the many creativity-enhancing guidelines discussed in class. [2 points]
 - c) Distinguish between basic and applied research. [2 points]
 - d) Science and research are intricately inseparable. Explain why neither can function without the other. [5 points]

3. In research, we find ourselves flitting back and forth between the theory realm and the observation realm and logic is one of the tools used extensively. {15 points}
 - a) Define logic. [2 points]
 - b) Distinguish between deductive and inductive logic and explain how each is used in the research process. Why do we need both in research? [5 points]
 - c) What is a logical fallacy? List four examples of logical fallacies. [6 points]
 - d) What would you do if your facts do not agree with theory? [2 points]

The University of Zambia
School of Agricultural Sciences
University First Half Examinations – March 2015

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4. Read the following excerpt from the introduction of a recently published journal article (Tembo et al. 2014) and answer the questions that follow. **{15 points}**

"Conventional wisdom contends that productive potential and market access are important ingredients for the development of the smallholder livestock sector. However, there is virtually no empirical evidence on the farmers' responsiveness to both these conditions. Do proximity to markets and abattoirs and/or good roads, for example, motivate farmers to increase their livestock production? This paper uses household data collected from livestock rearing communities in 3 districts in Southern Province of Zambia to measure the effect of the communities' productive potential and market access on livestock production. We also test for the existence of heterogeneous effects across agro-ecological regions, livestock species and poverty status of the household. Unlike most prior studies that use narrow measures of welfare like income or expenditure (Deshingkar et al., 2008, Greeley 1994), we use a more comprehensive participatory wealth ranking exercise to classify the households into wealth strata. To the best of our knowledge, no study has looked at all these issues so comprehensively within a mixed-methods framework.

Our study contributes to the literature in two other important respects. First, the study departs from the usual narrow representation of market access (distance to roads, markets, etc) (Ali and Khan 2013; Rooyen and Tui 2009) and uses knowledgeable key informants to assign market access statuses to study communities. The key informants use not only their knowledge of the distances but also several other factors, including, but not limited to, the state of the roads, and the size and versatility of market opportunities in general. This is much more informative than just distances. Second, our study unravels the differential responsiveness associated with different types of livestock, agro-ecological regions and poverty levels. The findings from this study should help in the design and implementation of effective interventions that aim to strengthen livestock-based livelihood systems in developing country contexts."

In not more than three sentences,

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

The University of Zambia
School of Agricultural Sciences
University First Half Examinations – March 2015

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THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION
MID-YEAR EXAMINATIONS FOR THE 2014/2015 ACADEMIC YEAR
AGE 4131: PRODUCTION ECONOMICS

Total marks: 100.

INSTRUCTIONS: Answer all questions, show your working and write succinctly where necessary.

Duration: Three (03) hours. **Date:** March 3rd, 2015. **Time:** 2:00 pm. **Venue:** Omnia Lt 2

Question one (20 marks)

Smallholder farmers in Nega-Nega land just realized that they face numerous challenges in their quest to improve agricultural productivity and they come to you for help. Being the Chief Agricultural Economist in the region, you rather decided to invite camp extension officers from Nega-Nega for a 7 day workshop in Livingstone. The ambitious camp extension officers were willing to learn from you and promised to later share the knowledge gained with the farmers back home. As the Chief Agricultural Economist with vast knowledge of production economics, use your knowledge to answer the following questions as part of a series of questions that were asked by the ambitious camp officers during the first day of the workshop;

- Distinguish between production and agricultural economics. (4 marks)
- What is the goal of factor-factor relationships? (4 marks)
- If one of the camp extension officers was also a farmer and faced one variable resource; inorganic manure and was producing maize, what would be your advice to him/her if his/her goal is to achieve economic efficiency? (4 marks)
- One of the camp extension officers suggested that because the farmers in Nega-Nega were maximizing their crop yields per hectare, they were in other words actually maximizing their net returns per hectare. Was this statement true or false? Explain. (4 marks)
- Another ambitious camp extension officer suggested that when the input price is constant, the slope of the total cost function will also be constant. Was he/she correct or wrong? Explain. (4 marks)

Question two (20 marks)

Production possibility curves can be derived directly from production functions. Given the following Cobb-Douglas production functions;

$$Y_1 = \frac{1}{2} X_1^{1/2} \text{ and } Y_2 = X_2^{1/2}$$

where the total amount of inputs are $K = X = X_1 + X_2$ and $P_{y1} = K20$ and $P_{y2} = K10$.

- Derive the production possibility equation in the positive quadrant. Show your working. (4 marks)
- Derive the product expansion path. (4 marks)
- What would be the maximum amounts of outputs (Y_1 and Y_2) you would produce given you have 58 units as total amounts of inputs at your disposal? (4 marks)
- Calculate the total amount of each input used in question c) above. (4 marks)
- Calculate the total revenue you would obtain given that the output prices are as given above. (4 marks)

Question three (20 marks)

Given that you produce two enterprises soybean (S_b) and maize (M_z) and that you face the following production functions. $S_b = 65.1 + 1.08F_{S_b} - 0.0038F_{S_b}^2$ and $M_z = 66.01 + 0.851F_{mz} - 0.003F_{mz}^2$, where S_b is soybean in kg/ha, M_z is maize in kg/ha. F_{S_b} is fertilizer in kg used on soybean while F_{Mz} is fertilizer in kg used on maize. Furthermore, assume you have 150 kgs of fertilizer in total to be used on soybean and maize hectares. Prices for soybean and maize are respectively K30 and K25 per kg.

THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION
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- Calculate the total amounts of fertilizers you would apply on both enterprises to maximize total farm revenue. (4 marks)
- Compute the total amounts of sorghum and maize you would produce using the amounts in a). (4 marks)
- What would be the total farm revenue? (4 marks)
- If in addition, you also had labour as a variable resource to employ on both enterprises, provide the generic principle you would employ in order to achieve economic efficiency. (4 marks)
- Distinguish between risk and uncertainty and give one example for each. (4 marks)

Question four (20 marks)

Assume that the farmer is operating in a perfectly competitive market model and is facing the following production function;

$$Y = (\sqrt{X_1} + \sqrt{X_2})^2 \text{ with } P_{x1} \text{ and } P_{x2}.$$

- Comment on the degree of the returns to scale of this production function. (4 marks)
- What stage of the classical production function is this farmer operating in? Why? (4 marks)
- Calculate the elasticity of substitution between X_1 and X_2 for the production function given in this problem and interpret it. (4 marks)
- Derive the isoquant and ridgeline equations. (4 marks)
- Define Net Present Value (NPV) and explain why it is used as one of the aspects of durable farm inputs. (4 marks)

Question five (20 marks)

Tersely define the following terms.

- Compounding costs (2 marks)
- Economies of outlay (2 marks)
- Derived demand for inputs (2 marks)
- Law of variable proportions (2 marks)
- Expansion path (2 marks)
- Supplementary products (2 marks)
- Lumpy inputs (2 marks)
- Envelope curve (2 marks)
- Net farm income (2 marks)
- Use depreciation (2 marks)

THE END



THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION EDUCATION
2014/2015 – MID ACADEMIC YEAR EXAMINATIONS

AGE 4211: INTRODUCTION TO AGRIBUSINESS MANAGEMENT

DURATION: 3HRS

DATE: 02/03/2014

INSTRUCTIONS: ANSWER ALL FIVE QUESTIONS.

QUESTION ONE

The word agriculture was usually associated with farm production activities. Until recently, this was a fairly accurate picture, but today's agriculture is radically different. It has evolved into what we now know as agribusiness.

- a. What is an agribusiness?
- b. Explain how and why agribusiness is considered as a value chain.
- a. What is the importance of agribusiness to the Zambian economy?
- b. Discuss the challenges faced by the agribusiness sector in Zambia

[4X5]

Total marks [20]

QUESTION TWO

What form of business organization would you consider for the following scenarios? Give justification and full details for your choice as it relates to each scenario.

- a. A family farm.
- b. A group of soybean farmers seeking to reduce their marketing costs.
- c. A Livestock feed firm seeking to expand in the near future.
- d. A breakfast cereal manufacturer who wants to collaborate with a juice company on a special promotion emphasizing the importance of good breakfast.

[4x5]

Total marks [20]

QUESTION THREE

- a. Discuss theory Z? In your discussion, highlight its origin, its key features and its importance as a management theory. (10)
- b. Discuss theory X and Y. In your discussion explain its relevance to management and illustrate how a Manager would apply it in his/her day to day activities. (10)

Total marks [20]

QUESTION FOUR

- a. A manager has to have managerial skills in order to perform their tasks effectively and diligently. Four managerial skills have been identified as technical, human, conceptual and design skills. For each managerial skill; Explain what each one is all about [4]
- b. A vegetable processing plant has different levels of managers and each manager has different responsibilities within this agribusiness. For the following managers, General Manager, Accountant, Marketing Manager and Plant Supervisor, explain the specific type of skills that each one requires? [6]
- c. What is job orientation and what is its importance? [4]
- d. What is promotion? What criterion is used to promote an employee? [6]

Total marks [20]

QUESTION FIVE

ZANTAC Corporation has calculated that it has fixed costs that consist of its lease, depreciation of its assets, executive salaries, and property taxes. Those fixed costs add up to \$60,000. Their product is the phablet. Their variable costs associated with producing the phablet are raw material, factory labor, and sales commissions. Variable costs have been calculated to be \$0.80 per unit. The phablet is priced at \$2.00 each. [4]

- a. What is the break-even point for ZANTAC Corporation's product, the phablet?
- b. If the economy is in a recession, ZANTAC's sales might drop. If sales drop, then ZANTAC might not sell the break-even point units in (a) above. In that case ZANTAC would not be able to pay all their expenses. To remedial this effect, ZANTAC could either cut down the General Managers salary by \$10,000 or reduce per unit cost of production of the phablet by \$0.2 per unit. Compute the new break-even points when the (i) fixed costs are reduced, (ii) variable costs are reduced (iii) both fixed and variable costs are reduced? [6]
- c. If there is a sudden high demand for phablets on the market, for ZANTAC to effectively supply the market with phablets, it will need to make use of a piece of modern equipment. It will cost the ZANTAC \$25,000 to purchase and install that equipment and this will increase its fixed cost to \$65,000. Alternatively, it could hire the equipment. Hiring the equipment would increase the variable cost per unit by \$0.5. Compute the break even points for the (i) buy scenario and (ii) the hire scenario. What action would you recommend to ZANTAC if it is to satisfy the sudden demand for phablets. [10]

Total marks [20]

End of Exam

The University of Zambia
School of Agricultural Sciences
Department of Agricultural Economics and Extension
2014/15 Academic Year Mid-Year Final Examinations
AGE 5151 International Agricultural Markets, Trade and Development

Date: Tuesday, 24th February, 2014 – Afternoon session

Venue: Omnia 1

INSTRUCTIONS

Answer ALL the questions in Section A and ONE (1) question in Section B

Section A (75 Marks)

- 1) The implications of trade imbalances are frequently misunderstood; a trade deficit is usually considered problematic while a trade surplus is a sign of economic strength. With the aid of illustrations, explain how running a trade deficit may be beneficial for a country contrary to expectations. (20 Marks)

- 2) Use the Heckscher-Ohlin model to:
- a) Explain why and how nations trade;
 - b) Explain what happens to factor markets when the prices of products are equalized between countries due to free trade.
 - c) Show the effects of a change in a nation's factor endowment.

(15 marks)

- 3) Briefly explain four (4) effects of movements to free trade on rentals and wages based on the specific factors model. (8 marks)

- 4) Use the information in the table below to answer the following questions. Show your work.

	Price of the <i>Economist</i> magazine per issue	Spot Exchange Rate (December 2, 1999)
United states	USD5.0	-
Japan	¥920	120 ¥/USD

- a) Calculate the absolute purchasing power parity exchange rates between Japan and the United States based on the price of the *Economist* magazine.

- b) Is the United States Dollar (USD) overvalued with respect the Japanese Yen (¥)?
Explain your answer.

(6 marks)

- 5) Outline six (6) market distortions and imperfections that would justify the use of trade policy instruments to raise aggregate economic efficiency in a Second-Best World.

(6 marks)

- 6) Suppose two large countries, Kenya and Ethiopia, trade with each other such that each country exports to and imports from the other. Both countries are faced with three distinct policy options: free trade, 10 percent import tariff and 20 percent Import tariff. The matrix below presents the national welfare payoffs based on the policy options available.

(Kenya, Ethiopia)		Ethiopia		
		Free trade	10% Tariff	20% Tariff
Kenya	Free Trade	(100, 100)	(70, 120)	(40, 140)
	10% Tariff	(120, 70)	(90, 90)	(60, 110)
	20% Tariff	(140, 40)	(110, 60)	(80, 80)

- a) Among the nine outcomes, which outcome would Kenya most prefer?
b) Among the nine outcomes, which outcome would Ethiopia most prefer?
c) Identify which cell(s) correspond(s) to a Nash (or non-cooperative) equilibrium.
Justify your answer.
d) Which cell corresponds to the cooperative equilibrium? Justify your answer.

(20 marks)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
2014/2015 MID-YEAR FINAL EXAMINATIONS
AGE 5251: AGRICULTURAL PROJECT PLANNING AND APPRAISAL
TIME: THREE HOURS
INSTRUCTIONS:

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

1. a) Explain why technical and economic aspects are important in project preparation and analysis (6 marks)
b) Are projects and programmes one and the same thing? Explain. (4 marks)
c) Discuss briefly the major stages of a project cycle. (10 marks)
2. a) What is the definition of a shadow price in economic analysis? (4 marks)
b) Why are shadow prices important in economic analysis? (6 marks)
c) Discuss briefly the relationship between shadow prices and opportunity cost (OC) as well as marginal value product (MVP). (10 marks)
3. The following investment outlay, operation and maintenance costs (cash outflows) as well as gross benefits (cash inflows) are given for a palm oil production and processing project proposal:

Amounts in ZKW' 000				
Year	Investment Outlay	Operation and maintenance	Production Cost	Gross Benefit
1	550	0	0	0
2	500	0	0	0
3	450	0	0	0
4	300	0	0	0
5	200	0	0	0
6	0	30	50	880
7	0	30	60	940
8	0	30	70	1000
9	0	30	80	1060
10	0	30	80	1060

- a) Compute the Net Benefit-Investment (N/K) ratio if the opportunity cost of capital is 20%. On the basis of the N/K you obtain, would you recommend the project as good investment? Explain why? (6 marks)
- b) Compute the Internal Rate of Return (IRR). On the basis of the IRR you obtain and given 20% as the opportunity cost of capital, would you recommend the project as good investment? Explain why? (10 marks)
- c) If a 2 year delay in project implementation reduces the net present value of the project's benefits to ZKW+6,000 whereas a 3 year delay reduces the net present value to ZKW-8,000, what is the magnitude (switching value) of the

THE UNIVERSITY OF ZAMBIA
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3	450	0	0	0
4	300	0	0	0
5	200	0	0	0
6	0	30	50	880
7	0	30	60	940
8	0	30	70	1000
9	0	30	80	1060
10	0	30	80	1060

- a) Compute the Net Benefit-Investment (N/K) ratio if the opportunity cost of capital is 20%. On the basis of the N/K you obtain, would you recommend the project as good investment? Explain why? (6 marks)
- b) Compute the Internal Rate of Return (IRR). On the basis of the IRR you obtain and given 20% as the opportunity cost of capital, would you recommend the project as good investment? Explain why? (10 marks)
- c) If a 2 year delay in project implementation reduces the net present value of the project's benefits to ZKW+6,000 whereas a 3 year delay reduces the net present value to ZKW-8,000, what is the magnitude (switching value) of the

project's delayed implementation before the net present value falls below unacceptable level? Explain your answer. (4 marks)

4. The following information is given for a centre pivot to be imported into the country: the c.i.f. price is US\$120,000; the import levy is 5% of the c.i.f. price; the handling and clearing charges amount to K15, 000 and the transportation to the project site is K5, 000. The official exchange rate (OER) is ZKW6.9 to US\$1 and a foreign exchange premium of 20% is estimated.
- Calculate the economic import parity value at the farm gate or project boundary using the conversion factor approach. (8 marks)
 - Calculate the economic import parity value at the farm gate or project boundary using the shadow exchange rate approach. (8 marks)
 - Why is it important to allow for a foreign exchange premium when calculating the economic import parity value? (4 marks)
5. The foreign exchange component and the domestic currency component of a phosphate production project are as given in the following table:

Year	Foreign Exchange Component (US\$ '000)			Domestic Currency Component (ZKW '000)	
	Value of Production	Investment Cost	Production Cost	Investment Cost	Production Cost
1	0	90	0	500	0
2	0	130	0	450	0
3	0	160	0	350	0
4	200	0	100	300	140
5	450	0	250	0	170
6	550	0	350	0	170
7	700	0	400	0	170
8	700	0	400	0	170
9	700	0	400	0	170
10	700	0	400	0	170

- If the opportunity cost of capital is 20%, compute the domestic resource cost (DRC). If the official exchange rate (OER) is ZKW 6.9 to US\$1 and on the basis of the DRC you obtain, is the project favourable? Explain why? (10 marks)
- If there is a foreign exchange premium of 20%, what is the shadow exchange rate (SER)? In the light of the SER you obtain and on the basis of the DRC you obtained in a) above, would you say the project is favourable? Explain why? (5 marks)
- Explain why it is important to estimate the DRC and for what type of projects it should be applied? (5 marks)

END OF EXAMINATION



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

2014/15 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

**AGF 2015
FUNDAMENTALS OF ORGANIC CHEMISTRY**

Date: 6th MARCH 2015

Time: 14:00 - 17:00 HRS

Venue: OMNIA 2

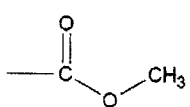
Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

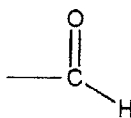
- 1. THIS PAPER CARRIES 100 MARKS AND HAS A TOTAL OF SIX (6) QUESTIONS.**
- 2. EACH QUESTION CARRIES 20 MARKS.**
- 3. ANSWER ANY FIVE (5) QUESTIONS.**
- 4. ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOKLET PROVIDED .**
- 5. USE ILLUSTRATIONS IN YOUR ANSWERS WHERE NECESSARY**

1.

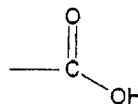
- a) Rank the following groups according to the highest priority and identify each functional group.



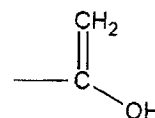
I.



II.



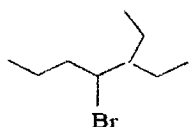
III.



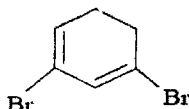
IV

(2 marks)

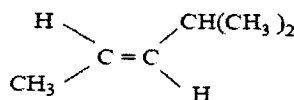
- b) Name the following compounds according to IUPAC nomenclature.



I.



II.



III.

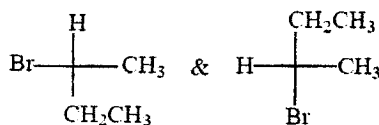
(6 marks)

- c) Draw the structure that corresponds to the following name (2 pts each):

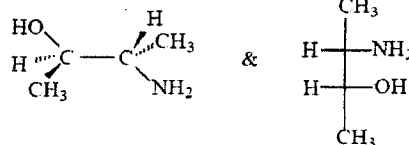
- I. (S)-2-bromobutane.
- II. (E)-3-iodo-2-pentene.
- III. 2,2-dimethyl-3-hexyne.

(6 marks)

- d) Determine whether the following pairs of compounds are identical, enantiomers or diastereomers. Also, give the absolute configuration (R or S) for each chiral centre.



I.

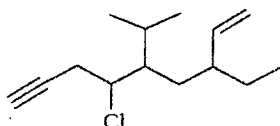


II.

(6 marks)

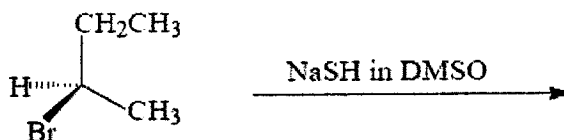
2.

- a) Name the following compounds according to IUPAC nomenclature:



(2 marks)

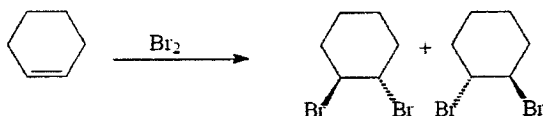
- d) The following reaction proceed through an S_N2 mechanism. Write the mechanism for this reaction.



(8 marks)

4.

- a) The bromination of cyclohexene gives the two compounds shown below. Assign *R* or *S* to each chiral center in the products. Are the two molecules similar?



(4 marks)

- b) When someone takes an analgesic like ibuprofen, only 50% of the drug will actually act as an anti-inflammatory agent.

I. Explain why this is the case and what happens to the remaining 50% of the drug?

(2 marks)

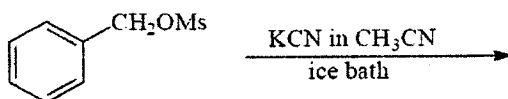
II. Why doesn't acetaminophen (Tylenol) have this characteristic (the entire tablet (100%) is an analgesic)?

(2 marks)

- c) (-)-Mandelic acid has a specific rotation of -158° . What would be the specific rotation of a solution which contains 40% (-)-mandelic acid and 60% (+)-mandelic acid?

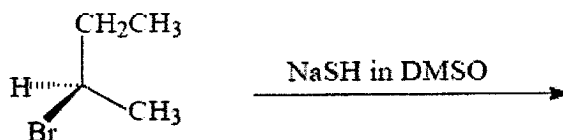
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(8 marks)

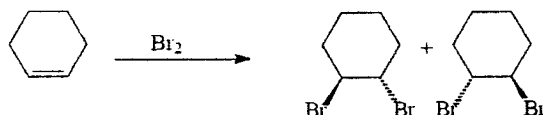
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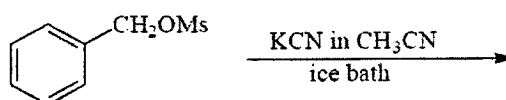
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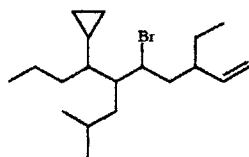
- d) The following reaction proceed through an S_N2 mechanism. Write the mechanism for this reaction.



(8 marks)

6.

a) Name the following compound according to IUPAC rules:



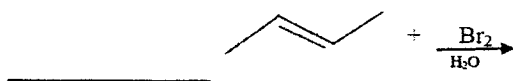
(2 marks)

b) Rank the following in the order of Carbocation Stability;



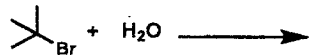
(4 marks)

c) Propose a mechanism of reaction for the following reaction.



(6 marks)

d) Predict the major organic product of the following reaction scheme and give a detailed S_N2 reaction mechanism for the formation of the predicted product.



(8 marks)

END OF EXAM



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

**INTRODUCTION TO INFORMATION
TECHNOLOGY AND COMMUNICATION
AGF 2401**

2014-2015 FINAL EXAM

Date: 27th February 2015
Venue: VET Lecture Theatre
Time: 14hrs
Duration: 3 Hour

Instructions

1. This exam has two sections
2. Answer **all** questions in Sections A
3. Section B has three (3) questions. Answer **any** two (2)
4. Write your answers on a separate answer sheet

SECTION A [40 Marks]

Answer all questions in this section.

1. The internet has changed the way we operate and communicate.
 - a) What is the internet? [1 Mark]
 - b) Give a brief description of internet history [5 Marks]
 - c) What is protocol in the internet? List six (6) examples of the internet protocols and explain what they are used for [3 Marks]
 - d) What is an IP address? [1 Marks]
 - e) List and explain five (5) risks that come with the internet [5 Marks]

2. In the 90s, we saw the emerging of a new way of sharing information on the internet called the web
 - a) Explain in details how the web technology works [7 Marks]
 - b) List down two (2) examples of web server [2 Marks]
 - c) List down four (4) examples of web browser [4 Marks]
 - d) State the relationship between the web address and the IP address [2 Marks]

3. The operating system (OS) manages and controls the operations of a computer. Explain the following components of Windows OS;
 - a) Remote Desktop [1 Mark]
 - b) Event Viewer [1 Mark]
 - c) Computer Management Console [1 Mark]
 - d) Task Scheduler [1 Mark]
 - e) Virtualization [1 Mark]
 - f) Command Line tool [1 Mark]
 - g) System information Tool [1 Mark]
 - h) Disk defragmenter [1 Mark]
 - i) Services [1 Mark]
 - j) Event Viewer [1 Mark]

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 - g) System information Tool [1 Mark]
 - h) Disk defragmenter [1 Mark]
 - i) Services [1 Mark]
 - j) Event Viewer [1 Mark]

SECTION B [60 Marks]

Answer any two (2) questions. Each question carries 30 Marks

1. A computer is a device that can perform computations and make logical decisions phenomenally faster than human beings can. Many of today's personal computers can perform billions of calculations in one second—more than a human can perform in a lifetime. Supercomputers are already performing thousands of trillions (quadrillions) of instructions per second! To put that in perspective, a quadrillion-instruction-per-second computer can perform in one second more than 100,000 calculations for every person on the planet! —these “upper limits” are growing quickly!

a) A computer is made up of hardware and software.

- i. What is computer hardware? [1 Mark]
- ii. What is Computer software? [1 Mark]
- iii. List down two types of computer software and give four (4) examples of each type listed [6 Marks]
- iv. Show by use of a diagram the Logical System architecture of a Computer [4 Marks]
- v. Explain the five (5) ways of acquiring software [5 Marks]
- vi. List down three (3) models of software development [3 Marks]

b) Explain the following computer hardware components

- i. Network Ports and Cables [1 Mark]
- ii. FireWire Ports and Cables [1 Mark]
- iii. USB Ports and Cables [1 Mark]
- iv. Serial Ports and Cables [1 Mark]]
- v. Internal Cables [1 Mark]
- vi. SRAM [1 Mark]
- vii. ROM [1 Mark]
- viii. PROM [1 Mark]
- ix. EPROM [1 Mark]
- x. EEPROM [1 Mark]

2. An operating system (OS) exploits the hardware resources of one or more processors to provide a set of services to system users. The OS also manages secondary memory and I/O (input/output) devices on behalf of its users.
- a) Explain the four roles of an operating system [4 Marks]
 - b) Explain in details the design of a 32-bit processor and a 64-bit processor. [6 Marks]
 - c) Explain the following characteristics of an Operating system
 - i) Multi-user [1 mark]
 - ii) Multitasking [1 Mark]
 - iii) Multiprocessing [1 Mark]
 - iv) Multithreading [1 Mark]
 - d) List down five (5) differences between the two types of Operating system. [7 Marks]
 - e) Explain the following Windows startup modes;
 - i) Safe Mode [1 Mark]
 - ii) Safe Mode with Networking Support [1 Mark]
 - iii) Safe Mode with Command Prompt [1 Mark]
 - iv) Last Known Good Configuration [1 Mark]
 - f) Windows Operating systems supports file extension.
 - i) Give three (3) attributes of a file [3 Marks]
 - ii) List two (2) examples of file extensions in windows OS [2 Marks]

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3. Application software is a type of software designed to be put to practical use. It gives the user a particular desirable output e.g. play a game, type a letter, e.t.c. Today there is a lot of software on the market.

a) An electronic spreadsheet is analogous to an accountant's ledger sheet. It contains rows and columns for entering character or numeric data.

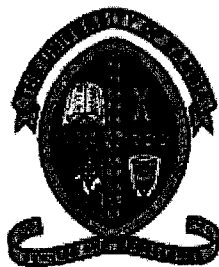
- i) List down two (2) examples of spreadsheet software [2 Marks]
- ii) Write down five (5) terminologies used in spreadsheet software [5 Marks]
- iii) List three (3) uses of spreadsheet software [3 Marks]

b) Word Processor manipulates text data to produce a letter, report, memo or any other type of correspondence.

- i) List down two (2) examples of word processor software [2 Marks]
- ii) Write down five (5) terminologies used in word processor software [5 Marks]
- iii) List three (3) uses of word processor software [3 Marks]

c) Presentation software is computer software that facilitates creation of a series of slides, i.e., a presentation

- i) List down two (2) examples of presentation software [2 Marks]
- ii) Write down five (5) terminologies used in presentation software [5 Marks]
- iii) List three (3) uses of presentation software [3 Marks]



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

2014/15 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

**AGF 3021
CHEMICAL TECHNIQUES IN FOOD ANALYSIS - THEORY EXAM**

Date: 3rd MARCH 2015

Time: 9:00 - 12:00 HRS

Venue: OMNIA 1

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER CARRIES 100 MARKS AND HAS A TOTAL OF SIX (6) QUESTIONS.**
- 2. EACH QUESTION CARRIES 20 MARKS.**
- 3. ANSWER ANY FIVE (5) QUESTIONS.**
- 4. ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOKLET PROVIDED .**
- 5. USE ILLUSTRATIONS IN YOUR ANSWERS WHERE NECESSARY**

1.

a) Explain in detail the following terms and give an example for each case:

I. Indeterminate (Random) Error.

II. Determinate (Systematic) Error.

(4 marks)

b) Standard Deviation is a term that is widely used in statistics as a measure of precision. Express this term in terms of the number of degrees of freedom and in terms of its variance.

(2marks)

c) The following replicates of weighing were obtained: 29.8, 30.2, 28.6, and 29.7 mg. Calculate the standard deviation of the individual values and the standard deviation. Express these deviations as absolute (units of measurements) and relative (% of the measurements) values.

(6 marks)

d) A sample that was analyzed by a laboratory had the following results of the concentration of Fe; 19.4, 19.5, 19.6, 19.8, 20.1, 20.3 ppm. Calculate the Standard deviation, Variance, Relative standard deviation and the Coefficient of variation.

(8marks)

2.

a) Distinguish between precision and accuracy of analytical data. Give an example for each case.

(2 marks)

b) List the Characteristics of a good Calibration and give an example for each case.

(4 marks)

c) List three main sources of determinate errors and briefly discuss how each of these errors are caused.

(6 marks)

d) A student took a calibrated 200.0 gram mass, weighed it on a laboratory balance, and found it read 196.5 g. and another student measured the specific heat of water to be 4.29 J/g · Cal. The literature value of the specific heat of water is 4.18 J/g · Cal.

I. Which of the two students had a big percent of deviation?

II. For each case, state the kind of errors and briefly discuss how each of these errors occur.

(8 marks)

3.

- a) List six basic principles of sampling from a Conveyor Belt. (3 marks)
- b) Explain why it is necessary to use a special pan that is of the exact size-width as the top of the chute splitter and why is it important to reduce the errors at each stage of splitting if a material is repeatedly split. Provide a simple sketch for the chute splitter. (3 marks)
- c) Explain in detail the mechanism of operation for each of the following methods for collecting samples; (6 marks)
- I. Linear Traversing Cut.
 - II. Rotational Traversing Cut.
 - III. Stationary Cut.
- d) Explain in detail the mechanism of operation, on how a 2.9kg sample of salt can be obtained from a 140kg bag. Given that the following Sampling devices are available. (8 marks)
- I. Chute type Sample splitter (maximum capacity- 150 kg)
 - II. Rotary riffle splitter (maximum capacity- 6 kg).

4.

- a) List the factors that affect Gross sampling for solids in fragments of varying size. (4 marks)
- b) Explain in detail the mechanism of operation for the following. (4 marks)
- I. Grab Sampling.
 - II. Coning and Quartering.
- c) (6 marks)
- I. Compare the separation factor and Resolution of a Chromatography.
 - II. What does the retention factor k' describe, give analysis of a separation with a very high value of k' .
- d) A mixture of hexane and ethyl benzene was separated using gas chromatography. The following results were obtained.

Compound	t_R min	t_w min
solvent	1.62	0.29
hexane	6.80	0.79
ethyl benzene	19.02	1.70

- I. Calculate the selectivity factor for hexane and ethyl benzene.
- II. Using the values from the table above calculate the resolution between hexane and ethyl benzene. (6 marks)

5.

- a) In reverse phase chromatography, list the characteristics that you would suggest for the stationary phase and explain its significance.

(2 marks)

- b) Explain in detail the method that would be recommended to separate an analyte that are extremely Hydrophobic (or) incompatible with water. List the characteristics for the mobile phase to be used.

(4 marks)

- c) Using the equation given for N, describe how to increase N, what effect it would have on a separation and define each term in the same given equation.

$$N = \frac{L^2}{\sigma^2} = \frac{L^2}{2Dt_r} = \frac{\mu_{ep} V}{2D}$$

(4 marks)

- d) The following data has been calculated from the chromatogram. The column is 100 cm long and the unretained marker takes 2 minutes to be detected.

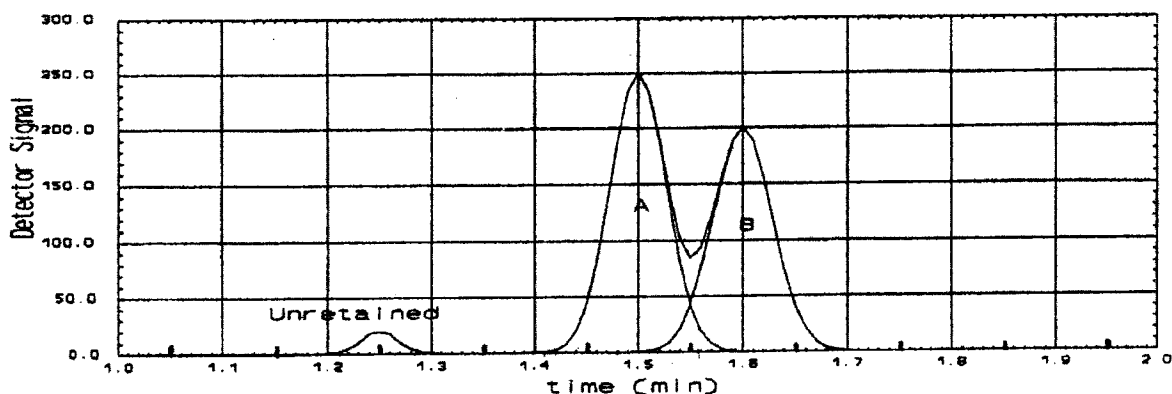
- I. Calculate the resolution for the peaks and how long must the column be in order to have this baseline resolution?
- II. Calculate the plate height, selectivity and retention factor (capacity factor).

Compound	Plate number	Retention factor
A	2450	6.4
B	2500	7.8
C	2850	8.8

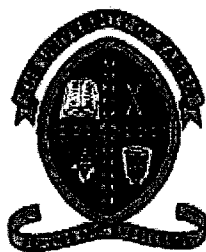
(10 marks)

6.

The figure below shows a portion of a GC chromatogram for a mixture of two aromatic compounds labelled A and B. The separation employed a 2.20 meter packed column under isothermal conditions (90 °C) and a flow rate of 12 mL/min. The figure shows the chromatogram in the region between 1.00 and 2.00 minutes, with the chromatograms expected for the individual components being overlaid.



- a) Calculate the capacity factors for each peak and the selectivity factor for the separation of A and B. (2 marks)
- b) Calculate the number of theoretical plates for peak B. (4 marks)
- c) For this separation, how would you improve the capacity factor? Be specific using the parameters of the separation that are provided. (6 marks)
- d)
 - I. Calculate the resolution of the two peaks.
 - II. Calculate the number of plates needed to increase resolution of the two peaks so that this value for resolution is obtained, if k' and α remain constant. (8 marks)



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

2014/15 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

**AGF 3021
CHEMICAL TECHNIQUES IN FOOD ANALYSIS - PRACTICE EXAM**

Date: 3rd MARCH 2015

Time: 12:00 - 14:00 HRS

Venue: FOOD SCIENCE LABORATORY

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER CARRIES 100 MARKS AND HAS A TOTAL OF FOUR (4) QUESTIONS.**
- 2. ANSWER ALL QUESTIONS.**
- 3. BE CAREFUL WITH CALCULATIONS AND BUFFERS.**
- 4. WEAR YOUR SAFETY GLASSES AT ALL TIMES.**
- 5. DO NOT WEAR CONTACT LENSES.**

Processing and Bottling of Bottled Drinking Water regulations in Zambia require that all water bottling company sample and analyze water frequently. A water bottling company has brought in water samples (W_1 and W_2) for testing at your facility and would like you to advise on the quality.

Analyse these samples and advise on the following:

1. Total hardness for the samples. (20 marks)
2. Calcium content in the samples. (20 marks)
3. Magnesium content in the samples. (20 marks)
4. Give a full detailed report of this analysis. (40 marks)

ADDITIONAL INFORMATION

- I. Molarity of EDTA solution is 0.01 M.
- II. mL of 0.01 M EDTA = 1 mg of CaCO_3

CAUTION

Be careful with the Calcium and Total hardness Buffers:

Spills on your skin or the floor are corrosive and should be washed off with soap and water immediately. Be sure to wear your safety glasses at all times as permanent blindness can easily result from strong bases splashed into your eyes.

Do Not wear contact lenses. Ask your instructor for further information.

END OF EXAM

Processing and Bottling of Bottled Drinking Water regulations in Zambia require that all water bottling company sample and analyze water frequently. A water bottling company has brought in water samples (W_1 and W_2) for testing at your facility and would like you to advise on the quality.

Analyse these samples and advise on the following:

1. Total hardness for the samples. (20 marks)
2. Calcium content in the samples. (20 marks)
3. Magnesium content in the samples. (20 marks)
4. Give a full detailed report of this analysis. (40 marks)

ADDITIONAL INFORMATION

- I. Molarity of EDTA solution is 0.01 M.
- II. mL of 0.01 M EDTA = 1 mg of CaCO_3

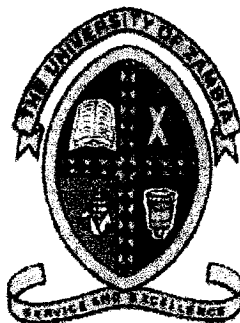
CAUTION

Be careful with the Calcium and Total hardness Buffers:

Spills on your skin or the floor are corrosive and should be washed off with soap and water immediately. Be sure to wear your safety glasses at all times as permanent blindness can easily result from strong bases splashed into your eyes.

Do Not wear contact lenses. Ask your instructor for further information.

END OF EXAM



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

2014/2015 ACADEMIC YEAR MID-YEAR EXAMINATION

**COURSE: AGF 3031
Food Chemistry (Theory)**

Date: 27th February 2015

Time: 09.00 – 12.00 Hours

Duration: THREE (3) HOURS

Venue: Omnia 2

INSTRUCTIONS TO CANDIDATES:

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

SECTION A

QUESTION 1

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

i. Hysteresis

(2 marks)

ii. Glassy state

(2 marks)

(b) Why can't water content be used effectively as an indicator of shelf stability of foods? (2 marks)

(c) In the refining of oils from lipid sources, briefly, explain the purpose of the hydrogenation stage (2 marks)

(d) Briefly, explain how the Acceptable Daily Intake (ADI) is experimentally obtained (2 marks)

QUESTION 2

You have developed a food product which is relatively white in colour and is in a powder form with good flowing properties. The developed product has the following food composition (wet basis): 7% water (with a water activity of 0.5), 10% crude protein, 65% carbohydrate, 5% lipids, 100ppm vitamin E, 50ppm iron (II), 100ppm of vitamin A and 50ppm of phytic acids. A laboratory analysis shows that carbohydrates in this food consist of starch and glucose in its free form. Proteins also consist of small amounts of the known 20 amino acids in their free form, polypeptides and peptides. This food is stored in an open space in a warehouse whose temperature increased from an average of 15°C to 35°C during the 14 days storage period. The food was stored in highly water permeable packaging material. The packaged food was stored in a warehouse with a relative humidity of 90%. Assume that the relative humidity of the warehouse remained constant throughout the storage period. During storage of this food at these conditions:

(a) What would happen to the water content and water activity of the food during the storage period? Explain your answer (5 marks)

(b) The food was found to deteriorate (i.e., lost its quality) during storage under these conditions. State and explain the deterioration due to lipids? (9 marks)

(c) State and briefly explain three quality properties that would be sensorially perceived in this food at the end of storage (6 marks)

QUESTION 3

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

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

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(2 marks)

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(2 marks)

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SECTION B

QUESTION 1

- (a) Why is there no enzymatic browning in intact tissues (3 Points)
- (b) What are the causes of mineral deficiencies in diets (2 points)
- (c) What is the major difference between vitamins and mineral loss during processing (2 Points)
- (c) What are Latent enzymes and what are they associated with in food chemistry (3 points)

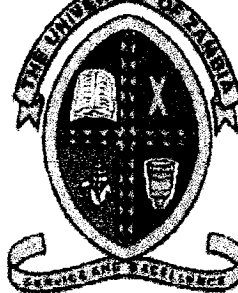
QUESTION 2

- (a) Describe in detail the **three** protein **putrification** processes. How different are these processes from protein denaturation (10 Points)
- (b) An industrialist producing dried vegetables comes to complain to you as a food scientist about their vegetables having hay like aroma. What explanation would you give to them about what is happening to their vegetables. What type of scientific advice would you give this person so that they produce dry vegetables without the hay like taste or aroma (10 Points)

QUESTION 3

- What are amylases? Describe in detail their role in starch hydrolysis, in your explanation include the hydrolysis products and their role in the food industry and human nutrition (20 Points)

END



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

2014/2015 ACADEMIC YEAR MID-YEAR EXAMINATION

**COURSE: AGF 3031
Food Chemistry (Practical)**

Date: 27th February 2015

Time: 14.00 – 17.00 Hours

Duration: THREE (3) HOURS

Venue: Omnia 2

INSTRUCTIONS TO CANDIDATES:

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

SECTION A

QUESTION 1

Some chemical and biochemical reactions can lead to alteration of food quality or food safety. For the reactions below, briefly explain how they affect food quality or safety and give an example of a food that may be affected by such reactions:

- (a) Non enzymatic browning (2 marks)
- (b) Enzymatic browning (2 marks)
- (c) Oxidation (2 marks)
- (d) Hydrolysis (2 marks)
- (e) Protein denaturation (2 marks)

QUESTION 2

The kjeldahl method of crude protein determination has three major steps, namely, (i) Sample digestion, (ii) Ammonia distillation (iii) Acid titration. Explain the following in each of the three steps.

(A) SAMPLE DIGESTION

- (i) Why are HgO, anhydrous K_2SO_4 and concentrated sulphuric acid added at this step? (2 Marks)
- (ii) If HgO and anhydrous K_2SO_4 were not available what else would you use? (2 Marks)
- (iii) Mention two factors that can affect digestion efficiency of the sample assuming the digestion temperature, HgO content, anhydrous K_2SO_4 content and sulphuric acid volume were added in correct amounts. (2 Marks)

(B) SAMPLE DISTILLATION

- (i) Why is the digested material diluted before distillation? (2 Marks)
- (ii) What is the function of NaOH, which is added at the distillation stage? (2 Marks)
- (iii) What is the function of boric acid in the receiver solution? (2 Marks)

(C) ACID TITRATION

- (i) What is standardization in titration? (2 Marks)
- (ii) Explain why it is important to standardize HCl used to titrate the receiver solution (2 Marks)

- (iii) You have just been given a new food product explain how you would calculate its nitrogen factor and how you can further calculate the crude protein content for the same food **(4 Marks)**

QUESTION 3

- (a) You have been given a sample to determine its mineral content. As an example, explain how you would proceed in determining the calcium content of a food, expressed in percentage. **(10 Marks)**
- (b) You have been given a sample to determine its crude fibre content, explain how you would carry out this experiment. What information would you give the client on the importance of fibre in the diet? **(10 Marks)**

SECTION B

QUESTION 1

What do you understand by the following terms and what is the importance of determining these in a food sample:

- | | |
|-------------------------|------------------|
| (a) Solid fat index | (2 marks) |
| (b) Water activity | (2 marks) |
| (c) Fatty acids profile | (2 marks) |
| (d) LD ₅₀ | (2 marks) |
| (e) Dry matter | (2 marks) |

QUESTION 2

(a) Assume you were in-charge of a laboratory determining moisture content of food and food products. A Non-governmental Organization has brought to your laboratory a high energy protein supplement (HEPS) to determine the moisture content. In order to determine the moisture content, you weighed a dry dish with its cover (27.5234g). To the weighed dish, you placed 2.0078g of HEPS in the dry dish. After loosening the cover, you placed the dish in an oven for 1 hour at 120°C. Thereafter, you removed the dish from the oven, tightened the cover quickly and cooled it in a desiccator for 1 hour. You weighed the dish with the cover again giving a weight of 29.3505g.

- (i) Calculate the moisture content (in %) on wet basis (wb) **(3 marks)**
- (ii) Calculate the moisture content (in %) on dry basis (db) **(2 marks)**

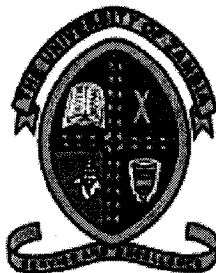
(b) Later, the same NGO asked you to determine the oil content of the same HEPS in Q2(a) above. In order to determine the oil content, you carefully ground and homogenized the HEPS. You gently mixed the HEPS prior to weighing the test portion. You weighed 5.0056g of HEPS and transferred the HEPS into the extraction thimble. You plugged lightly the mouth of the thimble with cotton wool. The oil was extracted with 250ml of petroleum ether for about 7 hours in a previously dried and weighed extraction flask, 27.1235g. After 7 hours of soxhlet extraction, you evaporated the solvent with a rotor evaporator. You then dried the extracted content at 60°C for 30 minutes and placed it in the dessicator to cool. After cooling for 1 hour, you weighed the extraction flask and its content, 27.6241g. The oil content was also determined on the same HEPS using a standard method. It was found that the fat content was 18.3% on dry basis.

- (i) Calculate the oil content (%) in the HEPS **(3 marks)**
- (ii) Calculate the oil content (in %) on dry basis (db) **(3 marks)**
- (iii) Express the oil content on wet basis as gH₂O/100g HEPS and kgH₂O/kg HEPS **(3 marks)**
- (iv) What is the recovery rate of the soxhlet method, and comment on the recovery rate of the soxhlet method? **(2 marks)**
- (v) What difference would you expect on the oil content if you used a methanol:chloroform (1:1) organic solvent mixture to extract the oil in the soxhlet method? Explain your answer. **(2 marks)**
- (vi) What other method would you use to determine the oil content in the HEPS? **(2 marks)**

QUESTION 4

Imagine you are running a food laboratory. A client who produces fatty foods brings a sample to you and claims that his/her customers are complaining that the food has a rancid odor. What quality properties (5 relevant properties) would you recommend to determine in your laboratory in order to prove or disapprove that rancidity is responsible for the customer's complaints. Explain why you have chosen each of the qualities you have mentioned and how they will show whether the food is rancid or not. **(20 marks)**

.....**End of Exam**.....



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

**2014/15 ACADEMIC YEAR MID-YEAR FINAL
EXAMINATIONS**

**AGF 3201
Technical Thermodynamics**

Date: Wednesday 25th February 2015

Time: 14:00hrs

Venue: Omnia II Lecture Theatre

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER CARRIES 100 MARKS.**
- 2. ANSWER QUESTION ONE (1) AND ANY OTHER FOUR (4).**
- 3. ALLOCATED MARKS FOR EACH QUESTION ARE INDICATED IN THE BRACKETS.**
- 4. USEFUL FORMULAE ARE LISTED ON THE LAST PAGE.**

Q.1

- a. A refrigerator uses refrigerant-134a as a working fluid and operates on an ideal vapour-compression refrigeration cycle between 0.14 and 0.8MPa. If the mass flow rate of the refrigerant is 0.05kg/s, determine
- i. the rate of heat removal from the refrigerated space and show the cycle on a T-s diagram with respect to saturation lines. [5]
 - ii. the power input to the compressor [3]
 - iii. the rate of heat rejection to the environment [3]
 - iv. the COP of the refrigerator [3]
- b. A heat pump that operates on the ideal vapour-compression cycle with refrigerant-134a is used to heat water from 15 to 54°C at a rate of 0.24 kg/s. The condenser and evaporator pressures are 1.4 and 0.32 MPa, respectively. Determine power input to the heat pump. [6]

Q.2

- a. Liquid water at 300kPa and 20°C is heated in a chamber by mixing it with superheated steam at 300kPa and 300°C. Cold water enters the chamber at a rate of 1.8kg/s. If the mixture leaves the mixing chamber at 60°C, determine the mass flow rate of the superheated steam required. [10]
- b. A Carnot heat engine operates between a source at 720°C and a sink at 25°C. If the heat engine is supplied with heat at a rate of 800kJ/min. Determine :
- i. the thermal efficiency [5]
 - ii. the power output of this heat engine [5]

Q.3

- a. A piston-cylinder device contains 25g of saturated water vapour that is maintained at a constant pressure of 300kPa. A resistance heater within the cylinder is turned on and passes a current of 0.2A for 5mins from a 120 V source. At the same time, a heat loss of 3.7 kJ occurs. Determine the final temperature of the steam. [10]
- b. Steam enters an adiabatic turbine at 8Mpa and 550°C with a mass flow rate of 3kg/s and leaves at 30kPa. The isentropic efficiency of the turbine is 90%. Determine:
- i. the temperature at the turbine exit [3]
 - ii. the power output of the turbine [7]

Q.4

- a. Explain the principle of a pressure cooker and state its application in the food industry. [8]
- b. Define the following:
- i. Compression ratio [1]
 - ii. Adiabatic process [1]
 - iii. Entropy [1]
 - iv. Compressibility factor [1]

- c. Describe with illustrations, the compression and power strokes in the actual cycle for a spark-ignition engine. **[8]**

Q.5

- a. Discuss the advantages and disadvantages of using ammonia as a refrigerant. **[5]**
- b. Discuss with illustrations, the difference between the Ideal and Actual Vapour-Compression Refrigeration cycles. **[15]**

Q.6

- a. Explain the assumptions which characterize a steady flow process. Give an example of a steady flow device and explain how it relates to heat transfer, work, and changes in kinetic and potential energies. **[10]**
- b. State and illustrate the second law of thermodynamics according to Clausius statement and give an example of its application in the food industry. **[10]**

End of Exam & Good Luck!!!

USEFUL FORMULAE

$$Q = \Delta U + W$$

$$\text{COP}_{\text{HP}} = Q_H / (Q_H - Q_L)$$

$$\text{COP}_{\text{HP}} = Q_H / W$$

$$\text{COP}_R = Q_L / W$$

$$\eta_{\text{th}} = W / Q_H$$

$$\Delta H = m c_p \Delta T$$

$$V = 4/3 \pi r^3$$

$$m = \rho v A$$

$$\theta = h + v^2/2 + gz$$

$$Q_{\text{in}} + W_{\text{in}} + \sum m_i \theta_i = Q_{\text{out}} + W_{\text{out}} + \sum m_e \theta_e$$

$$S = S_f + X S_{\text{fg}}$$

$$\Delta S_{\text{syst}} = Q / T_{\text{sys}}$$

$$W = m(h_1 - h_2)$$

$$P_1 V_1 / T_1 = P_2 V_2 / T_2$$

$$\Delta s = m c_v \ln(T_2 / T_1)$$

$$\Delta s = m c_p \ln(T_2 / T_1)$$

USEFUL FORMULAE

$$Q = \Delta U + W$$

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$$S = S_f + X S_{fg}$$

$$\Delta S_{\text{syst}} = Q / T_{\text{sys}}$$

$$W = m(h_1 - h_2)$$

$$P_1 V_1 / T_1 = P_2 V_2 / T_2$$

$$\Delta s = m c_v \ln(T_2 / T_1)$$

$$\Delta s = m c_p \ln(T_2 / T_1)$$

USEFUL FORMULAE

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$$\eta_{\text{th}} = W / Q_H$$

$$\Delta H = m c_p \Delta T$$

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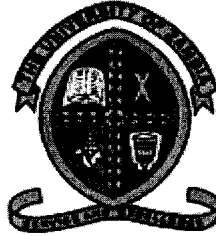
$$\Delta S_{\text{syst}} = Q / T_{\text{sys}}$$

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

BSC FOOD SCIENCE & TECHNOLOGY

NUTRITION

AGF 4065

2014-2015 MID-YEAR EXAMINATIONS

DATE: FRIDAY 6TH MARCH, 2015

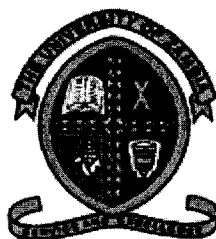
TIME: 09:00H

DURATION: THREE (3) HOURS

VENUE: VLT

INSTRUCTIONS TO THE CANDIDATES:

- 1. ANSWER ALL QUESTIONS**
- 2. ALL QUESTIONS CARRY EQUAL MARKS**



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

BSC FOOD SCIENCE & TECHNOLOGY

**NUTRITION
AGF 4065
2014-2015 MID-YEAR EXAMINATIONS**

DATE: FRIDAY 6TH MARCH, 2015

TIME: 09:00H

DURATION: THREE (3) HOURS

VENUE: VLT

INSTRUCTIONS TO THE CANDIDATES:

- 1. ANSWER ALL QUESTIONS**
- 2. ALL QUESTIONS CARRY EQUAL MARKS**

Question 1

Compare and contrast the different lipoproteins found in lipid digestion. Be sure to mention all the important apolipoproteins associated with each lipoprotein, site of synthesis and the function of each lipoprotein. **(20 marks)**

Question 2

- a) Describe in **brief** the digestion and absorption of Protein, Carbohydrates and Fiber **(12 marks)**
- b) For each of the following, list four (4) important physiologic body functions
 - i. Carbohydrates
 - ii. Protein

(8 marks)

Question 3

Define:

- a) Proto-oncogene **(2 marks)**
- b) Oncogene **(2 marks)**
- c) Tumour-suppressor gene **(2 marks)**
- d) What are the ten American Institute for Cancer Research (AICR) recommendations for cancer prevention? For each recommendation explain why/ how this is important and give examples where appropriate **(14 marks)**

Question 4

- a) Describe minerals including their characteristics in the body, bioavailability and mineral-mineral interactions **(10 marks)**
- b) List four (4) examples of minerals and for each list two (2) physiologic functions in the body and two (2) main food sources **(10 marks)**

Question 5

You are working as a nutritionist at Levy Mwanawasa hospital. A man and a woman with the same BMI come to the hospital for a regular check-up.

- a) Besides BMI, what other two nutritional assessments are you going to conduct on these individuals? **(1 mark)**

- b) Which nutritional assessment will you use to determine whether each one is at risk of heart disease? What is the cut-off for men and women in this case?(2 marks)
- c) You find that the waist-to-hip ratio of the man is 1.2 and the woman 0.83. How would you describe the types of bodies of the two and explain why this is important. (3 marks)
- d) Compare and contrast a food frequency questionnaire and 24-hour dietary recall.(6 marks)
- e) When you are done with your assessments, the woman mentions to you as a side note that osteoporosis is common in her family and would like as much as possible to avoid it. Which foods should she avoid to consume in excess and why? (8 marks)



**THE UNIVERSITY OF ZAMBIA
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DEPARTMENT OF FOOD SCIENCE & NUTRITION**

2014/15 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

**AGF 4221
PROCESS CONTROL AND INSTRUMENTATION**

**Date: 4th MARCH 2015
Time: 9:00 - 12:00 HRS
Venue: VLT**

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER CARRIES 100 MARKS AND HAS A TOTAL OF SIX (6) QUESTIONS.**
- 2. EACH QUESTION CARRIES 20 MARKS.**
- 3. ANSWER ANY FIVE (5) QUESTIONS.**
- 4. ANSWER EACH QUESTION IN A SEPARATE ANSWER BOOKLET PROVIDED .**
- 5. USE ILLUSTRATIONS IN YOUR ANSWERS WHERE NECESSARY.**

1.

- a) Define the following terms and give an appropriate example;

- I. Process.
- II. Manipulated variable.
- III. Controlled variable.

(3 marks)

- b) Explain the importance of mathematical modelling of a process in Process control.

(2 marks)

- c) The variable $y(t)$ depends on its first derivative and forcing function $x(t)$ such that at $t = t_0, y = y_0$. Given the following equation, find the general solution.

$$a(t) \frac{dy}{dt} + y(t) = K x(t)$$

(5 marks)

- d) With the help of a simple sketch, devise a Control System to fill a container with water after it is emptied by a stopcock at the bottom. The system must automatically shut off water when the container is filled. Considering that this system is first order system, develop a material balance expressing the liquid level as a function of time and explain the term t_{fill} .

(10 marks)

2.

- a) List four hardware elements that a control system is comprised of and Explain their significance in detail. Give one examples for each of these elements identified.

(4 marks)

- b) Illustrate how a first order dynamic system would respond to the following disturbances.

- I. Step disturbance.
- II. Pulse disturbance.

(4 marks)

- c) Consider a system's response which is defined by $y = y_H + y_1 + y_2$. Given that y_H decays toward zero from IC, that y_1 is the response to a step disturbance occurring at $t_1 = 1$, with gain of 3 and y_2 is the response to a step disturbance occurring at $t_2 = 2$ with gain of -4. Give analysis of this system's response.

(6 marks)

- d) Given that the overall material balance of an ideal process of filling a tank is presented below. Express the tank Volume in terms of the liquid level h (height of tank) and hence find the liquid level h as a function of time.

$$\frac{d\rho V}{dt} = \rho F_i$$

(6 marks)

3.

- a) List the Characteristics of a feedback control system. Explain in detail its ability to perform accurately and give an example.

(2 marks)

- b) A control scheme is the plan by which we intend to control a process. List four steps that are involved in developing a control scheme.

(4 marks)

- c) Given that x is a step function at t_1 and that y is the response of the system. y decays towards zero from initial conditions IC were $y_0 = t_0$ and then at t_1 the system begins to respond to a step disturbance. Illustrate the characteristics of a first order system responding to initial conditions and step disturbance.

(6 marks)

- d) Given that the control objective for a process is to keep the store house of fruit at a desired temperature set on the thermostat by the care-taker, in spite of unmeasured disturbances such as heat loss from the doors and windows opening, heat loss through the walls of the house.

- I. Develop a sketch showing all the necessary equipment working together.
- II. Develop feedback control configurations for this system.

(8 marks)

4.

- a) Discuss a system that exhibits first order dynamics. What are the principle characteristics of this system?

(3 marks)

- b) Develop a block diagram for an open-loop system. Give an example and discuss its ability to perform accurately.

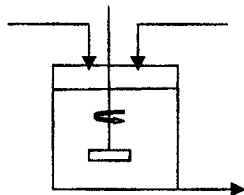
(3 marks)

- c) Develop a block diagram of a two-input control system in a home shower with separate valves for hot and cold water who's main objective should be to obtain a desired temperature of the shower water and flow rate. Explain the significance of this system.

(6 marks)

- d) Label the diagram below which shows an incomplete control system for maintaining the pH of a liquid at a required pH given that the Acid and the NaOH are both added to the tank using separate streams and that the liquid in the tank is kept at a desired level.

- i. Complete the control system and show all the necessary equipment working together.
- ii. Develop a Block diagram for the feedback control system showing both streams. Clearly show which stream you choose to manipulate.



(8 marks)

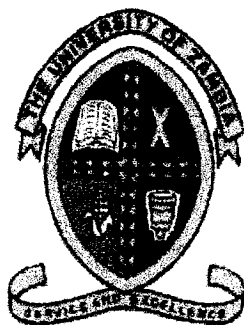
5.

- a) Explain in detail the stability of a system. Given an example. (4 marks)
- b) Develop a block diagram for a control system for the opening and closing of the air vent when the temperature rises or drops in a store house of vegetables. (4 marks)
- c) Develop a set of control algorithms using the controller error for the system given in question No. 5a. (6 marks)
- d) Draw a schematic block diagram of a home geyser system. Identify the functions of each element of the thermostatically controlled geyser system. What improvements would you make to this system and why would they be necessary. (6 marks)

6.

- a) Explain briefly the mechanism of operation in a feedback system. (4 marks)
- b) Develop a block diagram to show that an electric toaster is an open loop control system and explain why? (4 marks)
- c) Describe a common room air-conditioning system in terms of a process control loop and develop a block diagram for this system. (6 marks)
- d) The student – teacher learning process is inherently a feedback process intended to reduce the system error to a minimum. The desired output is the knowledge being studied and the student may be considered as the process. Construct a feedback model of the learning process and identify each block of the system. (6 marks)

END OF EXAM



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

2014/2015 ACADEMIC YEAR MID-YEAR EXAMINATION

**COURSE: AGF 5071
Food Colloids**

Date: 6th March 2015

Time: 14.00 – 17.00 Hours

Duration: THREE (3) HOURS

Venue: Omnia 2

INSTRUCTIONS TO CANDIDATES:

1. There are two (2) sections in this examination paper, Section 1 and Section 2.
 2. Answer **Five (5) questions** in total
 3. Answer **at least two (2) questions** from each section and the fifth (5th) question from either section 1 or 2
 4. The marks allocated are given at the end of each question.
 5. Answers to the two sections should be given in separate booklets.
-

SECTION 1: Answer at least 2 questions in a separate booklet

Question 1

- a. You are given a task to add a named emulsifier to a solution that has an interfacial tension of 72 mN/m at constant temperature over time in increasing quantities. What would you expect to happen to the interfacial tension of the solution with time (as the concentration of the emulsifier increases)? Support your answer by using a diagram. (10 marks)
- b. Emulsions can be destabilised through different physical mechanisms. Briefly discuss four (4) common ways in which an emulsion can be destabilised. (10 marks)

Question 2

- a. This question is based on Table 1 given in this paper. List and briefly explain three (3) conclusions that you can draw from the Table 1 given in relation to interactions between colloidal particles. (9 marks)
- b. A client from an unnamed company tells you that she was advised to add some starch to an emulsion to stabilise it. Explain to her very briefly how starch provides stability to emulsions (2 marks)
- c. Name three (3) different types of surfactants (a polysaccharide based one, a protein based one and a lipid based surfactant). For each of these surfactants, give one (1) food application where it is used and the type of emulsion (O/W or W/O) it forms in that named food system. (9 marks)

Table 1: Diffusion coefficient, D, and time, t, required for particles to move over a distance of 1 cm (on average) as a function of the particle radius

Particle radius	$D [m^2/s]$	$t = s_{rms}^2 / (2 \cdot D)$
0.01 mm	$2.15 \cdot 10^{-14}$	73 years
1 μm	$2.15 \cdot 10^{-13}$	7.3 years
0.1 μm	$2.15 \cdot 10^{-12}$	9 months
0.01 μm	$2.15 \cdot 10^{-11}$	27 days
1 nm	$2.15 \cdot 10^{-10}$	2.7 days

s_{rms} - Root mean square displacement; D - diffusion coefficient; s - seconds

SECTION 1: Answer at least 2 questions in a separate booklet

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- a. You are given a task to add a named emulsifier to a solution that has an interfacial tension of 72 mN/m at constant temperature over time in increasing quantities. What would you expect to happen to the interfacial tension of the solution with time (as the concentration of the emulsifier increases)? Support your answer by using a diagram. **(10 marks)**
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s_{rms} - Root mean square displacement; D - diffusion coefficient; s - seconds

Question 3

- a. Compare and contrast high pressure valve homogenisers and colloid mills
(10 marks)
- b. Describe in detail what happens for a droplet to break down into smaller droplets.
(10 marks)

SECTION 2: Answer at least 2 questions in a separate booklet

Question 1

(a) Write short notes on the following (maximum of five sentences each)

- i. Marangoni effect
- ii. Protein bridging
- iii. Critical Electrolyte Concentration/Critical Coagulation Concentration
- iv. Steric stabilization in emulsions
- v. Depletion flocculation

(10 marks)

(b) Assume two droplets at such a large distance apart such that their interaction is almost non-existent. Describe the process of coagulation between these two droplets in an emulsion using the DLVO theory.

(10 marks)

Question 2

(a) A droplet of corn oil is dispersed in an electrolyte solution of 0.1M of sodium chloride. Explain how the ions will distribute themselves around the droplet and give a reason to your choice of distribution

(10 marks)

(b) In a micro-electrophoresis experiment, a spherical particle of diameter $0.5\mu\text{m}$ dispersed in 0.1 mol/dm^3 aqueous solution of KCl at 25°C takes 8 seconds to cover a distance of $120\text{ }\mu\text{m}$, the potential gradient being 10 V/cm . Assume $D=78.55$ and the viscosity (η) of water at 25°C to be 0.89 Pa.s . Calculate

- (i) the electrophoretic mobility of the particle
- (ii) an approximate value of the zeta-potential of the particle

(3 marks)

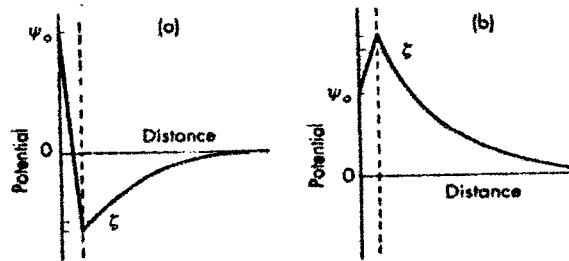
(7 marks)

Question 3

(a)

i) The graphs (a) and (b) describe the surface charges of charged surfaces under different conditions. Explain the circumstance(s) that could lead to the surface potential (potential of the charged surface) and the zeta potential (potential around the stern plane and beyond) to vary as described in each of the two graphs

(4 marks)



Figures (a) and (b)

- ii) What is meant by lyophobic dispersions and suggest two (2) conditions that make lyophobic dispersions stable? (3 marks)
- iii) When Ca^{2+} ions are added to soymilk, coagulation of the soymilk may be observed. Explain this phenomenon (3 marks)

(b) The behaviour of Newtonian and non-Newtonian liquids may be described using an empirical power law equation given below:

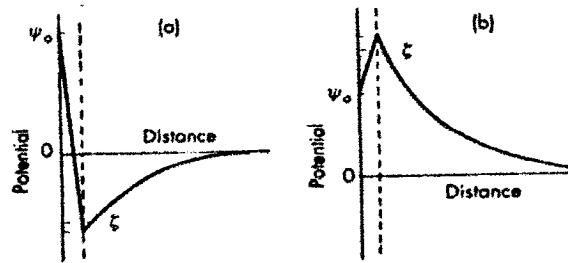
$$\tau = C^* (\dot{\gamma})^n$$

Where τ = stress, $\dot{\gamma}$ = strain, C = consistency index and n = the flow behaviour index

Use this equation to describe the Newtonian and non-Newtonian liquids

(10 marks)

END OF EXAM (FORMULAE AND CONSTANTS OVERLEAF)



Figures (a) and (b)

- ii) What is meant by lyophobic dispersions and suggest two (2) conditions that make lyophobic dispersions stable? **(3 marks)**
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(10 marks)

END OF EXAM (FORMULAE AND CONSTANTS OVERLEAF)

Formulae and constants for examination

$$\Gamma = -1/(R^*T) * (d\gamma / d\ln C) = -C / R^*T * d\gamma / dC$$

$$\Gamma = - (1/ (z^+ + z^-)) * 1/(R^*T) * (d\gamma / d\ln C) = - (1/ (z^+ + z^-)) * C/(R^*T) * (d\gamma / dC)$$

$$\Sigma = 1 / \Gamma$$

$$Pa_1 = (1/\Gamma) / N_A = \Sigma / N_A$$

$$\Delta P_L = 2 \gamma / r = -2 \cdot \gamma \cdot \cos \theta / r_c = h \cdot \delta \cdot g$$

$$(2 \cdot \pi \cdot r_c) \cdot \gamma \cdot \cos \theta = (\pi \cdot r_c^2 \cdot h) \cdot \delta \cdot g$$

$$\mu = \frac{\zeta * \varepsilon}{1.5\eta} \quad \text{Debye - Hückel equation}$$

$$\mu = \frac{\zeta * \varepsilon}{\eta} \quad \text{Helmoltz-Smoluchowski equation}$$

$$\mu = \frac{v}{E}$$

$$\kappa = \sqrt{(2 * Z^2 * F^2 * C_o / \varepsilon RT)}$$

$$\kappa = \sqrt{(2 * Z^2 * e^2 * n_o / \varepsilon kT)}$$

$$\kappa = 1.04 * 10^8 \sqrt{(C_o * Z^2)}$$

$$R^*T \ln [P_{vr}/P_{vo}] = 2 * \gamma * M / \delta * r = 2 * \gamma * V_L / r$$

$$t_{1/2, \text{slow}} = W * t_{1/2, \text{fast}}$$

$$t_{1/2, \text{rapid}} = 3 * \eta / (4 * k * T * N_o) = 2 * 10^{17} / N_o$$

$$N_o = fv / [(\pi/6) * \phi]$$

$$F = 96485 \text{ C / Mole}$$

$$e = 1.602 * 10^{-19} \text{ C}$$

$$R = 8.314 \text{ J / (mole.K)}$$

$$\varepsilon_o = 8.85 * 10^{-12} \text{ F/m}$$

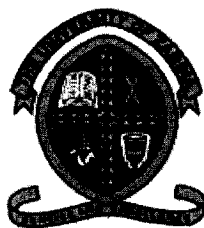
$$k = 1.38 * 10^{-23} \text{ J/K}$$

$$N_A = 6.023 * 10^{23}$$

$$\delta_{\text{H}_2\text{O}} \text{ at } 22^\circ\text{C} \approx 1000 \text{ kg/m}^3$$

$$g = 9.81 \text{ m/s}^2$$

$$\pi = 3.14$$



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

BACHELOR OF FOOD SCIENCE AND TECHNOLOGY

**PLANT DESIGN AND ENVIRONMENTAL MANAGEMENT
AGF 5241**

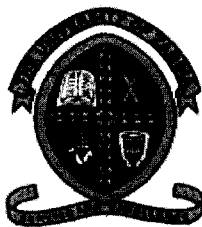
2014-2015 MID-YEAR EXAMINATIONS

DURATION: THREE (3) HOURS

VENUE: OTHER ROOMS

INSTRUCTIONS TO THE CANDIDATES:

1. PLEASE READ THE INSTRUCTIONS AND EACH QUESTION CAREFULLY.
2. THIS PAPER CARRIES 100 MARKS
3. **EACH QUESTION CARRIES 25 MARKS.**
4. ANSWER **ALL** QUESTIONS.



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
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1. A sugar processing plant is producing 10,000t/y of the product. The overall yield is 70 per cent, on a mass basis (kg of product per kg raw material). The raw material costs USD 10/t, and the product sells for USD 35/t. A process modification has been devised that will increase the yield to 75 per cent. The additional investment required is USD 35,000, and the additional operating costs are negligible.
 - a) Is the modification worth making? Show by performing detailed calculations and your judgment should be based on the economic evaluation criteria of projects such Rate of Return (ROR) and the Pay-back period. **(10 points)**
 - b) Briefly described two methods that you can use to estimate the total investment cost of the food processing project. **(5 points)**
 - c) List five elements of the operating cost that are important in food processing projects **(5 points)**
 - d) Besides economic performance, list five other factors that need to be considered when evaluating food processing projects. **(5 points)**
2. As a Plant Design Engineer, you have been tasked by the management of your company to design a compartment for pigs with length 9m, width 5m and height 4m. There are 72 pigs, each of them weigh 60 kg. The compartment should have mechanical ventilation and heat supply or heat withdrawal system. The outside temperature is 10°C and the outside relative humidity is 65%. The floor is to be perfectly insulated.

Physical constants

Specific heat capacity of air $C_{p,air} = 1.005 \text{ KJ.Kg}^{-1}.\text{K}^{-1}$

Heat of Vaporisation of water $\mathcal{E} = 2501 \text{ KJ. (Kg H}_2\text{O)}^{-1}$

Outside CO₂ concentration = $g_{o_{CO_2}} = 0.36 \text{ l.m}^{-3}$

Tolerable inside CO₂ concentration = $g_{i_{CO_2}} = 2.5 \text{ l.m}^{-3}$

Density of air $\rho_{air} = 1.27706 \text{ Kg .m}^{-3}$

K - Values

k_1 = Thermal conductivity for the walls = $1.163 \text{ W. } ^\circ\text{C}^{-1} . \text{m}^{-2}$

k_2 = Thermal conductivity for the roof = $0.638 \text{ W. } ^\circ\text{C}^{-1} . \text{m}^{-2}$

Some pig related data

Pig weight [kg]	T _{opt} [°C]	RH _{opt} [%]	Sensible heat Prod ⁿ [W/pig]	Latent heat Prod ⁿ [W/pig]	Co ₂ Prod ⁿ l/hr.pig
20	23	60	43	50	16
30	22	60	51	55	19
40	21	62	59	60	21
50	20	65	67	65	23
60	20	65	73	69	26
70	19	68	79	73	27
80	18	70	86	75	28
90	17	70	92	79	30
100	17	70	98	84	32

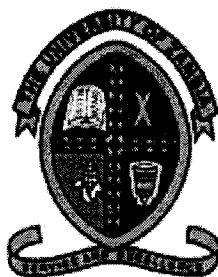
- a) Calculate the minimum ventilation rate required in the storage compartment **(7.5 points)**
 - b) How much heat supply or withdrawal, Q, is required to get the optimal temperature and humidity inside the compartment **(7.5 points)**
 - c) Suppose there is no heat supply or heat withdrawal system in the compartment, what ventilation rate is required to get the optimal inside temperature? Is this ventilation rate providing optimal indoor humidity? **(10 points)**
3. A potential investor would like to set up a sugar processing plant in Zambia and has approached you to do a market and location survey.
- a) List five environmental forces in the marketing environment that you would consider important, and that would have an impact on this firm **(5 points)**
 - b) In doing your market research, you may decide to use telephone, mail or personal contact method. For each method, give three advantages and three disadvantages **(7.5 points)**
 - c) Differentiate between structured and non-structured research method. **(5 points)**
 - d) With regard to sugar processing, give three structural forces that you think can create market entry barriers **(7.5 points)**
4. You have been asked to accompany the Minister of Agriculture and Livestock to witness the commissioning of a newly constructed mango juice processing plant in Mongu. As a Plant design engineer, what are your expectations on the following:
- a) Structural components (walls, floor, doors, windows and pipelines) **(6 points)**
 - b) Plant layout with regards to equipment **(8 points)**

- c) Sanitary facilities **(6 points)**
- d) Arrangement of rooms, areas and processes within the establishment **(5 points)**

END OF EXAMINATION

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- d) Arrangement of rooms, areas and processes within the establishment **(5 points)**

END OF EXAMINATION



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

**2014/15 ACADEMIC YEAR MID-YEAR FINAL
EXAMINATIONS**

**AGF 5321
Technology of Dairy & Egg products**

Date: Monday 23rd February 2015

Time: 14:00hrs

Venue: Omnia II Lecture Theatre

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER CARRIES 100 MARKS AND HAS TWO (2) SECTIONS.**
- 2. ANSWER ALL THE QUESTIONS IN SECTION 1 AND ANY TWO (2) FROM SECTION 2.**
- 3. ANSWER THE TWO SECTIONS IN SEPARATE ANSWER BOOKLETS.**
- 4. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS.**

SECTION 1: Technology of Dairy Products

1. Consumption milk is an important product in the dairy industry.
 - a. Explain with aid of an illustration, the manufacturing process of Pasteurised milk. **[15 marks]**
 - b. State how the process in (a) differs from the UHT and Sterilised milk manufacturing processes. **[5 marks]**

2. Eminchi Dairy Products is involved in the manufacture of Ice-cream. The company technical manager approaches you with a problem of their product having a sandy-mouthfeel with an ice structure. Explain:
 - a. the possible causes of the problem. **[4 marks]**
 - b. the different tests and checks you would carry out on the product and production line. **[4 marks]**
 - c. the possible solutions and make recommendations that will prevent the problem from recurring. **[4 marks]**
 - d. the causes of mastitis and its effect on milk composition. **[8 marks]**

3.
 - a. Explain the principle of milk separation in milk processing. **[4 marks]**
 - b. Show the soft cheese manufacturing process using a flow diagram. **[6 marks]**
 - c. Discuss the differences in manufacturing process of sweetened condensed milk and condensed milk. **[6 marks]**
 - d. Explain the importance of the cream ripening in butter making. **[4 marks]**

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SECTION 2: Technology of Eggs – Answer any two questions in a **separate booklet.**

1. Draw the egg and show its parts. From your diagram, show the part of the egg, which is a good emulsifier, explain why? Explain how egg porosity affects egg quality. Describe the other vital functional and nutritional properties of eggs. **[20 Marks]**
2. Describe how you would ensure that legal regulations, quality standards and consumer standards of eggs are met. **[20 marks]**
3. Egg processing and preservation is important in industry, why? Describe methods of egg preservation and the products produced. Explain in detail where these preservation products are used in industry. What processing methods should be avoided if the quality of eggs for future use is to be preserved? **[20 marks]**
4. Explain how the following analyses in eggs are carried out for each question include how you would interpret the results:
 - a. α -amylase why is its determination crucial **[10marks]**
 - b. Free fatty acid in dried eggs **[10marks]**



UNIVERSITY OF ZAMBIA

**SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND NUTRITION**

2014-2015 ACADEMIC YEAR MID-YEAR EXAMINATIONS

AGF 5615

PROCESSING AND PRESERVATION OF PLANT PRODUCTS

Date: 26th February, 2015

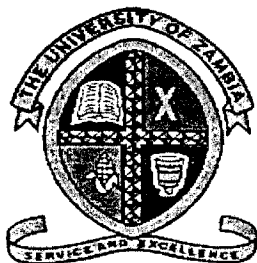
Time: 14.00

Venue: OMNIA LECTURE THEATRE

Duration: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES

1. THIS PAPER CARRIES 100 MARKS AND HAS 2 SECTIONS A AND B
2. ANSWER **ALL** THE QUESTIONS IN SECTION A IN SEPARATE BOOKLETS
3. ANSWER **ANY TWO** QUESTIONS IN SECTION B



UNIVERSITY OF ZAMBIA

**SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF FOOD SCIENCE AND NUTRITION**

2014-2015 ACADEMIC YEAR MID-YEAR EXAMINATIONS

AGF 5615

PROCESSING AND PRESERVATION OF PLANT PRODUCTS

Date: 26th February, 2015

Time: 14.00

Venue: OMNIA LECTURE THEATRE

Duration: THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES

1. THIS PAPER CARRIES 100 MARKS AND HAS 2 SECTIONS A AND B
2. ANSWER **ALL** THE QUESTIONS IN SECTION A IN SEPARATE BOOKLETS
3. ANSWER **ANY TWO** QUESTIONS IN SECTION B

SECTION A : Answer **all** questions. Each question must be answered in a separate booklet.

1. (a) In developing countries postharvest losses of cereals and grain legumes can be as high as 15%. Discuss the different types of postharvest losses that are likely to occur. **[10 marks]**
 - (b)
 - i) Describe the rice milling process. **[6 marks]**
 - ii) Describe the methods utilized to enhance nutrient retention during the rice milling process. **[4 marks]**
2. (a) Explain the manufacturing process of canned whole peeled tomatoes with aid of a flow diagram. **[15 marks]**
 - (b) Discuss the selective and elective conditions during fermentation processes. **[5 marks]**
3. Compare and contrast the processing of beet root and sugar cane starting with the raw material handling up to the production, storage and marketing of sugar crystals. **[20 marks]**

SECTION B: Choose **any two** questions from this section and answer each in separate answer booklet.

4. (a) Traditional fermented products are produced by a spontaneous fermentation process. Explain the principle of spontaneous fermentation and give two examples of traditionally produced products. **[5 marks]**

(b) With aid of a flow diagram, describe the wine making process. **[10 marks]**

(c) The Manager of HB Dried Fruits Ltd approaches you with a problem of discoloured (brownish) dried apples. Explain the causes of the problem and offer possible solutions. **[5 marks]**

5. Define the following

(a) Retrogradation and state its significance in starch hydrolysis. **[5 marks]**

(b) Liquefaction **[5 marks]**

(c) Maltodextrins **[5 marks]**

(d) Starch and starch hydrolysis products **[5 marks]**

6. (a) Give the chemical composition of potato (*solanum tuberosum*).
[8 marks].

(b) Discuss in brief (5 lines or less)

- i. Cyanogenic glycosides in cassava [2 marks]
- ii. Aleurone layer [2 marks]
- iii. Groundnut (*Arachis hypogea*) [2 marks]
- iv. Miscella [2 marks]
- v. Palm oil [2 marks]
- vi. Desolventizer toaster [2 marks]

- ALL THE BEST -

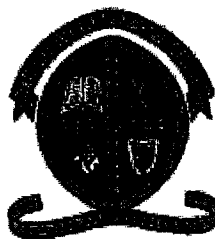
THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES AGRICULTURAL
DEPARTMENT OF ECONOMICS AND EXTENSION
2015 MID YEAR EXAMINATION
AGG3811: RURAL SOCIOLOGY

TIME: THREE (3) HOURS

TOTAL MARKS: 100

INSTRUCTIONS: ANSWER ALL QUESTIONS. EACH QUESTION CARRIES 20 MARKS

- 1) With practical examples, state the major sociological differences in the following concepts:
 - a) conjugal and consanguine family
 - b) Globalization and sustainable Development
 - c) Charismatic and bureaucracy
 - d) Competition and accommodation
 - 2) “A family as an institution is best described as an arena of conflict”
 - a) Define the terms family and institution
 - b) With at least **one** known theoretical perspective explain the extent to which the above statement is correct
 - c) State any **two** ways in which family is being affected by current the environment
 - 3) Examine with known case scenarios the “caste” and “class” forms of stratification stating the implication each one of these has on how people relate today
 - 4) Discuss why it is of practical significance that a student of rural sociology should be aware of cultural differences and increase their self knowledge of the subject?
 - 5) Durkheim uses the terminologies *Gemeinschaft* and *Gesellschaft* to identify and make clear the distinction between rural and urban societies. Using these two terminologies fully explain the distinction
-End.....



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

2014/2015 ACADEMIC YEAR MID-YEAR EXAMINATIONS

**COURSE: AGN 3311
NUTRITION ASSESSMENT**

Date: 2nd MARCH 2015

Time: 9.00 – 12.00 HRS

Duration: THREE (3) HOURS

Venue: OMNIA 2

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER HAS TWO SECTIONS: SECTION A AND B**
- 2. ANSWER ALL THE QUESTIONS IN BOTH SECTIONS.**
- 3. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS**

Answer all Questions in Section A and B

Section A

1. State four negative outcomes associated with chronic malnutrition. (4marks)
2. What are the Body Mass Index Cut-off values for adults as recommended by WHO (4 marks)
3. State and briefly explain two laboratory based methods that can be used to diagnose iron deficiency anaemia in individuals? (4 marks)
4. List any two biochemical methods that can be used to assess:
 - i. zinc deficiency (2 marks)
 - ii. iodine deficiency (2 marks)
5. What are the WHO recommended cut-offs for the prevalence of anaemia in the following groups of individuals: (4 marks)
 - iii. Children 6 – 59 months
 - iv. Non-pregnant women (> 15 years)
 - v. Pregnant women
 - vi. Men (>15 years)

State your answer in terms of haemoglobin concentration

6. State four sources of measurement error in dietary assessment (4 marks)
7. List four clinical signs of each of the following:
 - i. zinc deficiency (2 marks)
 - ii. Chronic malnutrition (2 marks)
8. Briefly explain why the associations between dietary diversity and nutritional status should be interpreted with caution? 4 marks
9. Outline four disadvantages of using the following methods in nutritional assessment.
 - i. Biochemical analysis (2 marks)

ii. Clinical assessment (2 marks)

10. What are the cut-off values for height for age using the Z-score classification as recommended by WHO? (4 marks)

Section B

Question 1

- a. Outline and briefly explain five factors that determine the absorption and utilization of nutrients by the human body. (10 marks)
- b. The WHO international reference standards for growth give the following reference data for a 48 month old boy:

Indicator	-3SD	-2SD	-1SD	Median	+1SD	+2SD	+3SD
BMI for age	12.1	13.1	14.1	15.3	16.7	18.2	19.9
Height for age	90.7	94.9	99.1	103.3	107.5	111.7	115.9

- i. If a 48 month old boy weighs 11.5kg, and has a height of 94cm, is he:
- Chronically malnourished only
 - Acutely malnourished only?
 - Both chronically and acutely malnourished?
 - None of the above

Show how you arrived at your answer.

4 Marks

- c. Briefly explain two arguments supporting the use of international reference standards in nutritional assessment. (4 marks)
- d. Explain how seasonality can affect child growth. (2 marks)

Question 2

- a. According to the Zambian National Food and Nutrition Commission (NFNC) report (2007), stunting rises dramatically from 6 months to 2 years (with

prevalence of 18% for children <6 months; and prevalence of 59% for children aged 18 – 24 months). Using appropriate examples from the Zambian context, explain four factors that contribute to this dramatic rise in stunting during this period. (8 marks)

b. With reference to question 1a above, briefly explain four interventions that have been put in place to prevent stunting in the First 1000 critical days (8 marks)

c. Explain four advantages of using BMI-for-age as a tool to assess growth. (4 marks)

Question 3

a. Discuss the age related changes in body size and body composition for the elderly and the difficulties these changes pose when taking anthropometric measurements in these group of individuals (10 marks)

b. Explain the alternative to height measurements for older adults (6 marks)

c. Can we use the same cut-offs for BMI for older adults? Explain your answer (2 marks)

d. Measurement errors are common in nutritional anthropometry. State four reasons for this. (2 marks)

Question 4

Explain the following methods of dietary assessment. For each method outline strengths and limitations in collection, analysis and interpretation of dietary assessment data.

i. Weighed food records (10 marks)

ii. Food frequency questionnaire (10 marks)

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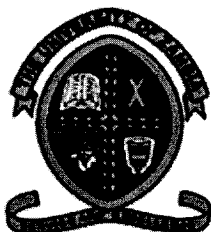
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Explain the following methods of dietary assessment. For each method outline strengths and limitations in collection, analysis and interpretation of dietary assessment data.

- i. Weighed food records (10 marks)
- ii. Food frequency questionnaire (10 marks)



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

BSC HUMAN NUTRITION

**NUTRITION DISORDERS
AGN 4241**

2014-2015 MID-YEAR EXAMINATIONS

DATE: TUESDAY 3RD MARCH, 2015

TIME: 09:00H

DURATION: THREE (3) HOURS

VENUE: OMNIA 1

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER CARRIES 150 MARKS AND HAS 2 SECTIONS;
SECTION A AND B**
- 2. ANSWER ALL THE QUESTIONS IN SECTION A. ANSWER
QUESTION 1 AND ANY OTHER THREE FROM SECTION B**
- 3. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE
BRACKETS**

PART A (5 marks each)

1. What is dyslipidemia? Why is it important?
2. Give two reasons why a baby may be born with a low birth weight (<2.5 kg).
3. List five American Institute for Cancer Research (AICR) recommendations for cancer prevention
4. What are the five steps for preventing hypertension?
5. Explain the concept stating that low birth weight infants are at an increased risk of obesity or chronic disease later in life (Barker theory)
6. Give two reasons why wasted children are at higher risk of death than stunted children
7. What are goitrogenic foods? Give two examples of goitrogenic foods and two examples of goitrogenic nutrients.
8. Explain the “double burden” of nutritional problems concept
9. Explain what is meant by the term “*Hidden hunger*”
10. What is the main role of Selenium in the body? How does the absence of Selenium result in goiter?

PART B (25 marks each)

Question 1 (Compulsory)

You are the health nutritionist at Kangwa clinic. A child with growth retardation, dermatitis and alopecia is presented to you.

- i. Which micronutrient is this child lacking? **(1 mark)**
- ii. Which genetic disorder is associated with this deficiency? **(1 mark)**
- iii. Upon further examination, you find that this child has muscle weakness, poor appetite and poor bone formation. Which other micronutrient is this child also lacking? Compare and contrast, osteomalacia, osteopenia and osteoporosis which would develop in this child's adulthood if left untreated. **(18 marks)**
- iv. When the child's mother is interviewed, it is found that this child is lactose intolerant. Why is this a risk factor to the conditions observed in iii. above? What foods would you recommend instead? **(5 marks)**

Question 2

- i. Define the term "nutrition transition" **(2 marks)**
- ii. Provide at least five reasons for nutrition transition **(5 marks)**
- iii. Discuss the most serious and problematic outcomes of nutrition transition **(8 marks)**
- iv. What are the stimulators of nutrition transition? **(5 marks)**
- v. Provide evidence for a claim stating that "***Nutrition transition is an emerging problem in Zambia***" **(5 marks)**

Question 3

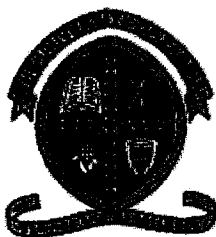
- i. Describe the stages through which malnutrition progresses **(6 marks)**
- ii. With the aid of the UNICEF conceptual framework, explain the causes of malnutrition **(10 marks)**
- iii. Provide a clear critique and/or limitation of the conceptual framework **(4 marks)**
- iv. Outline key messages arising from the use of the conceptual framework **(5 marks)**

Question 4

Describe in detail the progression of metastasis. (25 marks)

Question 5

- i. Define micronutrient deficiency **(2 marks)**
- ii. Discuss the impact of micronutrient deficiencies **(5 marks)**
- iii. Discuss Vitamin A as a micronutrient of public health significance in Zambia under the following
 - a. Classification **(1 mark)**
 - b. Functions **(5 marks)**
 - c. High risk groups **(3 marks)**
 - d. Deficiency signs and symptoms **(4 marks)**
 - e. Dietary sources **(2 marks)**
 - f. Interventions in place **(3 marks)**



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

2014/2015 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

BSc Human Nutrition

**COURSE: AGN 4321
RESEARCH METHODS AND EPIDEMIOLOGY FOR NUTRITIONISTS**

Date: 5TH MARCH 2015

Time: 14.00 – 17.00 HRS

Duration: THREE (3) HOURS

Venue: OMNIA 1

INSTRUCTIONS TO THE CANDIDATES:

- 1. THIS PAPER HAS TWO SECTIONS: SECTION A AND B**
- 2. ANSWER ALL QUESTIONS IN BOTH SECTIONS IN THE BOOKLETS PROVIDED.**
- 3. SPEND ABOUT ONE HOUR ON SECTION A AND TWO HOURS ON SECTION B.**
- 4. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN BRACKETS.**

Section A

Short answer questions

Question 1

Briefly describe the following study designs; and give two strengths of each.

- a. Ecological studies (2.5 marks)
- b. Cohort studies (2.5 marks)

Question 2

Suggest two confounding factors that may occur in the following case control studies:

- a. the association between fruit consumption and lung cancer (2.5 marks)
- b. dietary fat intake and the risk of breast cancer (2.5 marks)

Question 3

What research designs would be preferable when investigating the following topics?

- a. Effect of vitamin A supplementation in reducing cataracts in children under 5 years in a given community (1 mark)
- b. Dairy products, calcium intake, and breast cancer risk (1 mark)
- c. Prenatal influences on disease in later life (1 mark)
- d. Diet and diabetes in migrants to USA (1 mark)
- e. Assessment of the association between sun exposure and skin damage in beach volleyball players (1 mark)

Question 4

Explain the difference between *incidence* (2.5 marks) and *prevalence* (2.5 marks) of disease.

Question 5

a) Suggest **two ways** of expressing each of the following exposures:

- i. Fruit intake (2 marks)
- ii. Body fatness (2 marks)

b) Suggest **one way** of measuring sugary drink consumption (1 mark)

Question 6

State any five points a researcher should consider when writing for a lay audience (1 mark each)

Question 7

A cohort study of alcohol use and incidence of fatal myocardial infarction yielded the information provided in the table below:

	<u>Fatal Myocardial Infarction</u>		
	<u>Yes</u>	<u>No</u>	<u>Total</u>
Alcohol consumed daily	20	20	40
Alcohol never consumed	10	30	40
Total:	30	50	80

Calculate the appropriate measure of association between exposure and disease and say what it means.

Question 8

a) Give an example of an exposure that is a:

- i. binary variable (1 marks)
- ii. continuous variable (1 marks)

b) Explain how a continuous variable could be expressed as a binary variable, with an example. (3 marks)

Question 9

A study was carried out to examine the dietary habits of overweight school-aged children compared with normal weight children. School children were asked to complete 4-day food diaries. After the data were analysed it was found that the average daily energy intake of overweight children was 1700kcal compared with 1800 kcal in normal weight children.

Explain these findings with reference to *information bias*. (5 marks)

Question 10

List five criteria necessary to demonstrate causation in epidemiological studies. (1 mark each)

Section B

Long answer questions

Question 1

A cohort study was carried out in a region of Swaziland to explore the association between consumption of aflatoxin-contaminated groundnuts and risk of liver cancer. 17,000 people were recruited to a study. At baseline, a urinary biomarker of aflatoxin exposure was measured, and all people in the cohort were followed up over 15 years, for mortality from liver cancer.

The following information was collected – 6,300 people had evidence of high exposure to aflatoxin, of whom 145 died of liver cancer. 10,700 people showed evidence of low exposure to aflatoxin, of whom 115 died of liver cancer.

- Draw a table to show exposure to aflatoxin, and death from liver cancer in this cohort. (7 marks)
- Calculate the relative risk of dying from liver cancer for people with high aflatoxin exposure compared to those with low exposure. (7 marks)
- Explain the meaning of the relative risk you have calculated. (7 marks)
- How would you expect the relative risk to change following a programme to reduce contamination of groundnuts with aflatoxin in this region? Explain your answer. (4 marks)

Question 2

- Discuss the importance of using randomized controlled trials for nutrition policy making, in preference to using only case-control studies and cohort studies. (15 marks)
- Explain why it is not always easy to use RCTs in studies of diet and disease risk. (10 marks)

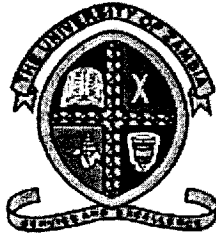
Question 3

- Briefly explain the various steps in the research process (12 marks)
- Explain the following probability sampling procedures:
 - stratified random sampling (4 marks)
 - systematic random sampling (4 marks)
- Outline the steps involved in conducting a systematic review (6 marks)
- State three limitations of systematic reviews specific to health promotion (3 marks)

Question 4

- Briefly explain four main distinguishing characteristics between qualitative and quantitative research (8 marks)

- b. State and briefly explain any two methods used to collect data in qualitative studies (5 marks)
- c. What are the challenges associated with using food frequency questionnaires in collecting dietary data in nutritional epidemiology studies. (8 marks)
- d. List any four software tools that can be used to analyze data in nutrition studies. (4 marks)



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

2014/15 ACADEMIC YEAR MID-YEAR FINAL EXAMINATIONS

AGN 5421: FOOD SERVICE SYSTEMS MANAGEMENT
BSc HUMAN NUTRITION PROGRAMME

Date: 4th March 2015

Time: 09:00 – 12:00 Hrs

Venue: Omnia 1

Duration: THREE (3) HOURS

INSTRUCTIONS TO THE CANDIDATES:

1. THIS PAPER CARRIES 100 MARKS AND HAS TWO SECTIONS: A AND B.
2. ANSWER ALL THE QUESTIONS IN SECTION A (20 MARKS)
3. THERE ARE FIVE (5) QUESTIONS IN SECTION B, ANSWER ONLY FOUR (4) QUESTIONS (80 MARKS)
4. ALLOCATED MARKS FOR EACH SECTION ARE INDICATED IN THE BRACKETS

SECTION A (20 MARKS)

ANSWER ALL QUESTIONS IN THIS SECTION.

1. In catering/food production, what do you understand by the term “portion control”.
(2 Marks)
2. Mention four (4) points of the ten (10) points of the code of personal hygiene.(2 Marks)
3. State the meal service style which is most applicable to nursing or retirement home based foodservice systems. Mention two characteristics of the referenced meal service style.
(2 Mark)
4. As head of a nutrition unit in the establishment, you entered into a verbal contract with a supplier who did not perform as expected. In litigation, a tort was established. What is a tort?(2 Marks)
5. Define the term “food”as per the Food and Drugs law.(2 Mark)
6. Using an example, illustrate why quality control assurance measures in a foodservice production system are considered to be more effective thanthose pertaining to quality control procedures?(2 Marks)
7. Besides contributing to quality control assurance objectives, how else can quality circles benefit employees of an organization such as a foodservice facility? (2 Marks)
8. There are seven HACCP principles, one of which is to have established record keeping procedures. The HACCP regulation requires every participating facility to maintain relevant data records, state at least two (2) of the main records required.(2 Marks)
9. In food safety, name the bacterium that causes Botulism, a rare but serious paralytic illness.(2 Marks)
10. As a First Aider, you arrive at the accident scene, examine the situation and you decide to call 911. You then describe to an EMR person that one casualty has a cut skin with jagged, irregular edges probably caused by a forceful piece of metal tearing away of the skin tissue. What type of an open wound is it? (2 Marks)

SECTION B (80 MARKS)

THERE ARE FIVE (5) QUESTIONS IN THIS SECTION. ANSWER ONLY FOUR (4) QUESTIONS. EACH QUESTION IS WORTH 20 MARKS.

- 1) The foodservice manager is responsible for the safety of food in a foodservice establishment. Briefly describe four (4) essential measures that the manager must put in place in order to ensure a safety environment. **(20 Marks)**
- 2) Draw and discuss the conceptual model that summarizes the responsibilities of the state (government), the food service institution (company) and the employees (human capital) in the legislation procedures for food service systems. **(20 Marks)**
- 3) Foodservice departments in hospitals or institutions have foodservice systems or methods of how they would serve the food to patients. Using a five (5) point rationale, **contrast** between plates service and bulk food service in relation to benefits and concerns that may arise. **(20 Marks)**
- 4) The input of a Nutritionist/Dietician is cardinal in menu planning. Name and briefly explain four (4) factors that need to be considered during menu planning. **(20 Marks)**
- 5) The foodservice component of the hospitality industry can be classified into two (2) systems:
 - a) Identify the referenced foodservice systems **(2 Marks)**
 - b) **Compare** and **contrast** characteristics of the said foodservice systems. **(16 Marks)**
 - c) Give two (2) examples per referenced foodservice system. **(2 Marks)**

END OF EXAMINATION



UNIVERSITY OF ZAMBIA
UNIVERSITY MID-YEAR EXAMINATIONS – FEB, 2015
AGS 3711: AGROCLIMATOLOGY

Time: Three (03) Hours **Total Marks:** 100
Instructions: Answer All Questions
Non-programmable calculators are allowed

1. Define the following terms. [15 Marks]
 - a. Actual vapour pressure
 - b. Dew point temperature
 - c. Radiative forcing
 - d. Radiation depletion
 - e. Tropopause
 - f. Weather
2. The meteorological department wants to set a standard automated meteorological station in Chongwe to serve farmer in the area. [20 Marks]
 - a. What factors do you need to consider when setting up a meteorological station? Give a brief outline of the set up.
 - b. Outline parameters measured at a standard meteorological station and give an instrument which can be deployed for measuring each parameter.
3. A farmer obtained meteorological parameters of Lusaka, 15.5° S and 28.5° E, for 15th August 2014 from meteorological station near his farm as shown in a table below. [30 Marks]

Parameter	
Daily maximum air temperature	29 °C
Daily minimum daily air temperature	18 °C
Mean relative humidity	50%
Expected clear sky shortwave radiation	25 MJ m ⁻² d ⁻¹
Shortwave radiation	21 MJ m ⁻² d ⁻¹
Average wind speed at 2m	3 m s ⁻¹
Pan evaporation	4 mm
Surface albedo	0.3
Air pressure	96 k Pa

Calculate

- Relative sun-earth distance
 - Sunset hour angle and hence, sunrise and sunset
 - Net radiation
 - Mean saturation vapour pressure
 - Actual vapour pressure
 - Reference evapotranspiration
4. The government of Zambia has set up priorities in improving agricultural production for sustainable economic development. [25 Marks]
- Briefly explain five different ways in which your knowledge from the Agroclimatology course can be applied to agriculture.
 - Discuss three non-agricultural applications of climatology.
 - In line with your knowledge of different agro-ecological regions of Zambia, discuss factors which need to be considered for rain-fed crop production in each region.
5. Describe the physical structure of the earth's atmosphere. [10 Marks]

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5. Describe the physical structure of the earth's atmosphere. [10 Marks]

Equations and constants

$$\delta_s = \sin^{-1} \left[\sin 23.45 \sin \left(\frac{360}{365} (J - 81) \right) \right] \quad \delta_s = 0.409 \sin \left(\frac{2\pi}{365} J - 1.39 \right)$$

$$J = \left(275 \frac{M}{9} - 30 + D \right) - 2 \quad J = 30.4M - 15$$

$$\omega_s = \cos^{-1} [-\tan(\varphi) \tan(\delta_s)] \quad \omega_s = \tan^{-1} \left[\frac{-\tan(\varphi) \tan(\delta_s)}{\left(1 - \langle \tan(\varphi) \rangle^2 \langle \tan(\delta_s) \rangle^2 \right)^{0.5}} \right]$$

$$d_r = 1 + 0.033 \cos \left(\frac{2\pi}{365} J \right) \quad R_s = \left(a + b \frac{n}{N} \right) R_a \quad e_T = 0.6108 e^{\left[\frac{17.27T}{237.3 + T} \right]}$$

$$RH = \frac{e_a}{e_s} (100) \quad R_a = \frac{24}{\pi} S_o d_r [\omega_s \sin(\varphi) \sin(\delta_s) + \cos(\varphi) \cos(\delta_s) \sin(\omega_s)]$$

$$\lambda E T_{ref} = \frac{0.408 \Delta (R_n - G_0) + \gamma \left(\frac{900}{T + 273.16} \right) u_2 (e_s - e_a)}{\Delta + \gamma (1 + 0.34 u_2)} \quad R_{ns} = R_s (1 - \alpha)$$

$$R_{nl} = \left(\frac{T_{\max}^4 + T_{\min}^4}{2} \right) \left(0.34 - 0.14 \sqrt{e_a} \right) \left(1.35 \frac{R_s}{R_{so}} - 0.35 \right) \quad R_n = R_{ns} - R_{nl}$$

$$\Delta = \frac{4098 (0.6108 \exp \left[\frac{17.27T}{T + 237.3} \right])}{(237.3 + T)^2}$$

$$S_o = 1400 \text{ W m}^{-2}, \quad \gamma = 0.0662 \text{ kPa } ^\circ\text{C}^{-1}, \quad a = 0.25, \quad b = 0.5$$

THE UNIVERSITY OF ZAMBIA
UNIVERSITY MID YEAR EXAMINATIONS – FEBRUARY 2015

AGS 4221
SOIL AND PLANT ANALYSIS

TIME: 3 HOURS

Marks: 100

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

1. Discuss the four stages of soil testing and clearly give the importance of each one of the stages. **[20 Marks]**
2. A soil sample was analysed and the following chemical data were obtained **[10 Marks]**:

Exchangeable cations (cmol/kg)						
pH	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	Al ³⁺	H ⁺
4.4	0.16	0.04	0.03	0.01	1.1	0.01

- a. What information would you need to know in order to make a meaningful interpretation of the given pH value? **[4 Marks]**
 - b. How much lime is required per hectare to grow a crop that tolerates an aluminium saturation of 10% if the available lime has an effective neutralizing value of 79%. Assume a bulk density and soil depth of 1400 kgm⁻³ and 0.20 m, respectively. **[6 Marks]**
3. To determine plant extractable K in soil, 10 g of soil is equilibrated in 50 ml of 1M ammonium acetate for 30 minutes. The suspension is then filtered using Whitman filter paper. The concentration of K in the filtrate determined on the flame photometer is 5 mg/l **[10 Marks]**:
 - a. State the functions of K in plants. **[2 marks]**
 - b. Express the reading in mg K/kg soil and cmol K.kg soil⁻¹ **[2 marks]**
 - c. Would this soil meet the nutrient requirements for a crop that needs 70 kg of K per hectare? Show calculations, to support your answer. (Assume a 20 cm plough layer with density of 1.3g/cm³) **[2 marks]**
 - d. What is the excess or deficit of K in the soil for the above crop in K₂O equivalent? **[2 marks]**
 - e. What are the symptoms of K deficiency in plants? **[2 marks]**
4. Phosphorus (P) is one of the essential elements required for plant growth. **[20 Marks]**

- What are the three (3) requirements should an element meet to be classified as an essential element? [3 marks]
- List two (2) plant available forms of P. [2 marks]
- A variety of solutions are used to extract plant available P from soils. State three (3) extraction solutions that have been known to correlate well with plant uptake in Southern Africa. [3 marks]
- What are the mechanisms by which P removed from the soil in the extraction solutions stated in (c) above? [3 marks]
- Describe briefly the method you would use to determine total P in plant tissue. [4 marks]
- Would applying 200 kg of Compound D fertilizer (10:20:10) per hectare on a soil that contains 10 mg/kg P be able to meet the nutrient requirements for a crop which needs 25 kg P/ha? (Assume a 20 cm plough layer with bulk density of 1.4 g/cm³) [5 marks]

Useful data: Atomic masses- P = 31 g, O = 16, K = 39

- Soil biological communities are characterized using different approaches. The measurement of soil microbial biomass is one such approach. Answer the following: [20 Marks]

- Why is the measurement of soil microbial biomass an integrative approach? [3 Marks]
- How is microbial biomass related to soil organic matter? [2 Marks]
- Explain the theory, assumptions and procedure of measuring soil microbial biomass using the chloroform fumigation incubation method [10 Marks]
- Assuming a titre of 0.098, calculate the microbial biomass in soil sample from Msekera and Liempe given the following laboratory back titration results after incubation of 100 g of soil for 7 days: [5 Marks]

Sample	Amount of 0.1 M HCl consumed (ml)	
	Phenolphthalein Color Shift	Methyl orange Color Shift
Blank	7.0	2.4
Fumigated Liempe Soil	7.3	8.3
Unfumigated Liempe Soil	1.8	5.3
Fumigated Msekera Soil	1.2	7.1
Unfumigated Msekera Soil	1.4	5.7

The amount of carbon dioxide-carbon respired per kilogram of wet soil per day is calculated as follows:

$$r = ((\text{volume of HCl consumed for sample} - \text{volume of HCl consumed blank}) * 10t * 1.2 * 10) / n$$

where: r = respiration in mgCO₂-Carbon/ kg soil per day

1.2= equivalent amount of C for 1 cm³ 0.1 M HCl

N= number of days of incubation

t= titre. Also note that the number 10 is for conversion from 0.1 to 1kg soil.

END OF EXAMINATION

NOTE: A STATISTICAL TABLE IS ATTACHED WITH NECESSARY DATA YOU MAY REQUIRE

iii.

Assuming the cost of obtaining maize yield data per farmer in a social economic survey is K20.00, how much would it cost to obtain data to estimate the average yield of maize grown under canopies of *Faidherbia albidia* in metric tonnes per hectare) with a margin of error of 100 kg/ha at a confidence level of 95 %. Show the necessary calculations to support your answer. [5 Marks]

ii.

Assuming the yield data for maize are normally distributed, are there any outliers in the yield data for maize grown outside canopies of *Faidherbia albidia*? Show calculations to support your answer. [4 Marks]

i.

From the data above and at a confidence level of 95 % would you conclude that growing maize under canopies of *Faidherbia albidia* results in significantly higher yields than growing maize outside canopies of this tree? Show all the calculations to support your answer. [5 Marks]

Answer the following questions:

Farm Number	Maize yield (mt/ha) Under canopies	Maize yield (mt/ha) (outside canopies)
1	5.2	1.73
2	6.15	1.33
3	7.73	1.47
4	4.93	3.60
5	3.07	2.93
6	5.60	3.20
7	3.60	2.40
8	6.40	2.80
9	2.80	0.53
10	3.07	0.67

- a. A client wants to establish whether there is a significant difference in the phosphate status of two portions of a cultivated field where crop yields have been observed to differ. Describe how you would go about collecting soil samples from this field up to the stage of having them ready for laboratory analysis. Give reasons to justify your answer. [6 marks]
- b. In a study of the influence of *Faidherbia albidia* on soil fertility, maize was grown in fields with *Faidherbia albidia* (Musangu tree). Maize was planted under and outside the canopies of this tree. The Table below shows maize yields in metric tonnes obtained from maize grown under canopies of *F. Albidia* and outside canopies of *F. albidia* in Southern Province.

6. Sampling soils and plant materials and interpreting data obtained from laboratory and field measurements are an essential part of the work of a professional Soil Scientist. Answer the following questions briefly and concisely [20 Marks]:

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Farm Number	Maize yield (mt/ha) Under canopies	Maize yield (mt/ha) (outside canopies)
1	5.2	1.73
2	6.15	1.33
3	7.73	1.47
4	4.93	3.60
5	3.07	2.93
6	5.60	3.20
7	3.60	2.40
8	6.40	2.80
9	2.80	0.53
10	3.07	0.67

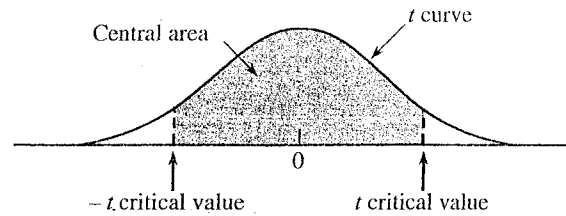
Answer the following questions:

- i. From the data above and at a confidence level of 95 % would you conclude that growing maize under canopies of *Faidherbia albida* results in significantly higher yields than growing maize outside canopies of this tree? Show all the calculations to support your answer. [5 Marks]
- ii. Assuming the yield data for maize are normally distributed, are there any outliers in the yield data for maize grown outside canopies of *Faidherbia albida*? Show calculations to support your answer. [4 Marks]
- iii. Assuming the cost of obtaining maize yield data per farmer in a social economic survey is K20.00, how much would it cost to obtain data to estimate the average yield of maize grown under canopies of *Faidherbia albida* (in metric tonnes per hectare) with a margin of error of 100 kg/ha at a confidence level of 95 %. Show the necessary calculations to support your answer. [5 Marks]

NOTE: A STATISTICAL TABLE IS ATTACHED WITH NECESSARY DATA YOU MAY REQUIRE

END OF EXAMINATION

t critical values



Central area captured:		.80	.90	.95	.98	.99	.998	.999
Confidence level:		80%	90%	95%	98%	99%	99.8%	99.9%
Degrees of freedom	1	3.08	6.31	12.71	31.82	63.66	318.31	636.62
	2	1.89	2.92	4.30	6.97	9.93	23.33	31.60
	3	1.64	2.35	3.18	4.54	5.84	10.21	12.92
	4	1.53	2.13	2.78	3.75	4.60	7.17	8.61
	5	1.48	2.02	2.57	3.37	4.03	5.89	6.86
	6	1.44	1.94	2.45	3.14	3.71	5.21	5.96
	7	1.42	1.90	2.37	3.00	3.50	4.79	5.41
	8	1.40	1.86	2.31	2.90	3.36	4.50	5.04
	9	1.38	1.83	2.26	2.82	3.25	4.30	4.78
	10	1.37	1.81	2.23	2.76	3.17	4.14	4.59
	11	1.36	1.80	2.20	2.72	3.11	4.03	4.44
	12	1.36	1.78	2.18	2.68	3.06	3.93	4.32
	13	1.35	1.77	2.16	2.65	3.01	3.85	4.22
	14	1.35	1.76	2.15	2.62	2.98	3.79	4.14
	15	1.34	1.75	2.13	2.60	2.95	3.73	4.07
	16	1.34	1.75	2.12	2.58	2.92	3.69	4.02
	17	1.33	1.74	2.11	2.57	2.90	3.65	3.97
	18	1.33	1.73	2.10	2.55	2.88	3.61	3.92
	19	1.33	1.73	2.09	2.54	2.86	3.58	3.88
	20	1.33	1.73	2.09	2.53	2.85	3.55	3.85
	21	1.32	1.72	2.08	2.52	2.83	3.53	3.82
	22	1.32	1.72	2.07	2.51	2.82	3.51	3.79
	23	1.32	1.71	2.07	2.50	2.81	3.49	3.77
	24	1.32	1.71	2.06	2.49	2.80	3.47	3.75
	25	1.32	1.71	2.06	2.49	2.79	3.45	3.73
	26	1.32	1.71	2.06	2.48	2.78	3.44	3.71
	27	1.31	1.70	2.05	2.47	2.77	3.42	3.69
	28	1.31	1.70	2.05	2.47	2.76	3.41	3.67
	29	1.31	1.70	2.05	2.46	2.76	3.40	3.66
	30	1.31	1.70	2.04	2.46	2.75	3.39	3.65
	40	1.30	1.68	2.02	2.42	2.70	3.31	3.55
	60	1.30	1.67	2.00	2.39	2.66	3.23	3.46
	120	1.29	1.66	1.98	2.36	2.62	3.16	3.37
z critical values	∞	1.28	1.645	1.96	2.33	2.58	3.09	3.29

THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS: FEB-MARCH, 2015

AGS 5121

SOIL GENESIS AND CLASSIFICATION

TIME: THREE (3) HOURS

INSTRUCTIONS: ANSWER ALL QUESTIONS

TOTAL MARKS: 100

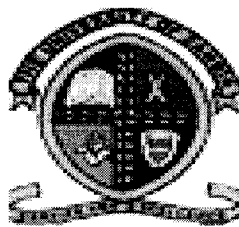
1. Compare and contrast the genesis of the following:
 - i. Histic and Umbric epipedons (2 marks)
 - ii. Plaggen and Anthropic epipedons (2 marks)
 - iii. Argillic and Natric horizons (2 marks)
 - iv. Oxic and Spodic horizons (2 marks)
 - v. Slickensides and Gilgai microrelief (2 marks)
- 2.a. Explain giving examples the Soil Series concept and its significance in soil classification. (5 marks)
- b. Explain the rationale for development of the FAO/UNESCO Soil Map of the World. (5 marks)
- 3.a. Compare and contrast the chemical and physical properties of organic matter and non-crystalline amorphous materials and explain their importance in soils. (5 marks)
- b. The mineralogy of the clay fraction of Soil A is dominated by olivine, pyroxenes and amphiboles while that of Soil B is

dominated by gibbsite, hematite and kaolinite. Discuss the state of development of these soils and the implications on their chemical and physical fertility . (5 marks)

- 4.a. Chernozems, Kastanozems and Phaeozems are characterized by having a Mollic epipedon. Explain the major diagnostic differences among them. (5 marks)
- b. Alisols, Luvisols and Lixisols are characterized by having an Argic (Argillic) horizon. Explain the major diagnostic differences among them. (5 marks)
- c. What aspects of soil composition do Leptosols and Regosols have in common? Explain why they are classified differently. (5 marks)
5. Give a comparative analysis with examples, of how the factors of soil formation influence soil development in tropical and temperate environments. (15 marks)
6. Explain the chemical and physical challenges in the agricultural utilization of the following soils and suggest ways to alleviate them:
 - i. Gleysols (2 marks)
 - ii. Solonchaks (2 marks)
 - iii. Arenosols (2marks)
 - iv. Plinthosols (2marks)
 - v. Calcisols (2 marks)
7. An investor is proposing to develop an irrigation project in agroecological zone I of Zambia. Give an analysis of the soils of this area and show how they are likely to respond to irrigation development. (10 marks)

8. A soil has been classified in USDA Soil Taxonomy as: Clayey, Kaolinitic, Isohyperthermic Typic Haplustox. Give a detailed description of the following:
- a. Major soil forming factors and processes involved in its genesis. (5 marks)
 - b. Major chemical, physical and environmental characteristics of the soil. (5 marks)
 - c. Soil use and management considerations for sustainable agricultural use. (5 marks)
 - d. Environmental implications in utilizing these soils for arable cropping. (5 marks)

END OF EXAMINATION



The University of Zambia

School of Agricultural Sciences

Final examinations- February-March, 2015

AGS 5131: Soil Survey and GIS Techniques

Time: 3 hours

Total Marks: 100

Instruction: There are six (6) questions in this paper. Answer all the questions

Question 1: You have been hired by a commercial farmer to conduct a soil survey on his farm in Chisamba. The size of his farm is 3550 hectares. His intention is to produce wheat, maize, paprika, and Lucerne as a fodder crop.

- a) What method of soil survey would you use? (Explain why) **(5 marks)**
- b) At what scale would you map his farm? (Explain why) **(5 marks)**
- c) What would be the most appropriate map units for such a survey? **(5 marks)**
- d) Explain the main steps you would undertake in the process of soil survey **(10 marks)**

Question 2: In soil survey projects, soil surveyors do not actually map soils as such because they only observe soils at a small number of locations in a landscape. But soil maps are created for the entire landscape. Explain how this is possible **(10 Marks)**

Question 3: Assume that a soil unit has been defined on the basis of sand content. The sand content in a certain map unit is measured at 5 randomly selected points as shown below:

Point 1-----15 %

Point 2-----12%

Point 3-----24%

Point 4-----30%

Point 5-----8%

- a) What is your comment on the accuracy of this mapping given that the maximum soil variability should not exceed 10%? **(5 marks)**
- b) Explain what soil variability is and its significance in soil mapping **(5 marks)**
- c) What is the appropriate way of expressing soil variability in a soil survey? **(3 marks)**
- d) What are the major causes of soil variability within mapping units? **(7 marks)**

Question 4: You have been requested to provide preliminary information on the data requirements for a GIS that is to be used to hold an inventory of soil resources in Kafue district as an input for planned land use planning of the area. Your GIS should be able to hold broad categories of soil types. For each of the questions listed below, provide a short paragraph justifying your choices (why have you decided on your particular choice over possible alternatives) and consider any possible limitations, drawbacks or problems that may arise from these.

- a) What is the primary data collection method/source of data for the application? Do alternatives exist? **(5 marks)**
- b) What is the most appropriate scale for the digital map data sets that are to be produced? **(5 marks)**
- c) What are the key considerations in the choice of Datum of the digital map data sets? **(5 marks)**
- d) What map projection and co-ordinate system would you chose for this application? **(5 marks)**

Question 5:

- a) Given that you are supplied with a map of soil acidity for Lusaka Province. Compare and contrast vector and raster data models as a suitable means of representing and analyzing **(10 marks)**
- b) Provide a short justification of which spatial data model you would use and why **(5 marks)**

Question 6: Write down three applications of where you think overlay, buffering or a combination of the two could help you solve a problem. **(10 marks)**

END OF EXAM



UNIVERSITY OF ZAMBIA

FIRST HALF EXAMINATIONS –FEBRUARY 2015

AGS 5411: SOIL MICROBIOLOGY

Time: Three (3) Hours

Marks: 100

Instructions: Answer all Questions

1. Growth in general can be defined in different ways. Investigating the growth and reproduction of individual microorganisms can be a challenge; therefore, microbiologists will follow changes in the total population when studying growth. Based on your understanding of microbial growth, answer the following questions:
- Explain how one arrives at the formula final population $b = a * 2^n$ where a is the initial population and n is the number of generations. [5 marks]
 - Explain how generation time of a given microbial population is calculated as $g = 0.301t / (\log b - \log a)$ where t is the given time, a is the initial population and b is the final population. [5 marks]
 - Given the following information, calculate the final microbial population b after 24 hours in culture: [10 marks]

Bacterium	g (minutes)
<i>Bacillus cereus</i>	20
<i>Pseudomonas fluorescens</i>	35
<i>Rhizobium leguminosarium</i>	120
<i>Nitrosomonas europaea</i>	660

2. There are many methods of determining soil microbial populations some of which count total cell numbers while others count only viable or live cells. Direct plating is a method used to count the number of viable cells in a sample.
- Explain the procedures for the spread plate and pour plate methods [6 marks]
 - Explain the procedure for 'serial dilution' and why it is particularly important for the methods you have explained in (a). [5 marks]

- c. Assuming that 150 colony forming units (CFUs) on a 1.0 ml dilution are observed and the final population is determined to be 3×10^8 CFU /g soil, calculate the dilution factor. **[5 marks]**
- d. Explain why it is more appropriate to express microbial populations in CFU/g soil than as cell/g soil for this enumeration? **[4 marks]**
3. Briefly explain the following processes on soil nitrogen:
- a. Transformation of nitrogen from ammonium to nitrate **[2.5 marks]**
 - b. Changes in the oxidative state and role of soil microorganisms in nitrification **[2.5 marks]**
 - c. Transformation of organic nitrogen (RNH_2) to NH_4^+ and NO_3^- under laboratory conditions **[7.5 marks]**
 - d. Influence on both symbiotic and non-symbiotic biological nitrogen fixation by available forms of nitrogen **[5 marks]**
 - e. Soil nitrate removal from ground water. **[2.5 marks]**
- 4.
- a. Explain how you would demonstrate differences in the nitrogen fixing capabilities of two legumes growing under the same environmental and soil conditions. **[7.5 marks]**
 - b. Discuss how extremes of pH can influence both symbiotic and non symbiotic nitrogen fixation and indicate if these two processes will be influenced differently. **[7.5 marks]**
5. The decomposition of organic matter results in the production of a heterogeneous mixture of complex organic compounds.
- a. With the aid of the diagram, discuss the properties of soil organic matter fractionation products. **[20 marks]**
 - b. Which component of organic matter plays an active part in the fertility and nutrition of plants? Give reasons to support your answer. **[5 marks]**

-End-



**UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES
DEPARTMENT OF SOIL SCIENCE**

AGS 5511

AGRICULTURE HYDRAULICS AND IRRIGATION DEVELOPMENT

MID-YEAR EXAMINATIONS - 2015

ANSWER: ALL QUESTIONS

ANSWER QUESTION 6 IN A SEPARATE ANSWER BOOK

TIME: THREE (03) HOURS

MARKS: ALL QUESTIONS HAVE EQUAL MARKS.

FRIDAY 27TH FEBRUARY 2015

Q1. Consider a bore hole which is in a confined, homogeneous, isotropic aquifer of hydraulic conductivity K . The borehole reaches the bottom of the aquifer. At the start, the piezometric surface is horizontal as there is no ground water movement in any direction. Pumping of water then starts at a rate of Q (m^3/day).

Explain the meaning of the following terms or phrases as they relate to the above described borehole. Further explain what is the use of these terms or phrases in hydraulics.

- (i) Piezometric surface
- (ii) Pumping water level
- (iii) Draw down
- (iv) Well yield
- (v) Specific capacity
- (vi) Cone of depression

Explain what happens when pumping continues in the above case.

Q2. When pumps are manufactured and sent to the dealers the manufacturer provides four (04) different characteristic curves for every pump. The four (4) curves are given but not labelled. Label them. The characteristic curves are:

- (i) Total Dynamic Head versus discharge
- (ii) Net positive suction Head Required versus Discharge
- (iii) Brake Power versus Discharge
- (iv) Efficiency versus Discharge.

Describe what each of the curves is showing or representing. What is its use in understanding pumps? How do you select the pump you need using pump characteristic curve?

Q3. Irrigation serves to add water to the soil so that the plant can absorb water which is so essential to plant growth and performance. Explain what would be the ideal situation with regard to water addition so that the plant achieves near its maximum potential in terms of growth, yield and quality of produce.

Q4. Draw or sketch the components of a sprinkler system of irrigation from start to the end.

(a) Name all the components indicating what they do and what they are made of.

(b) Describe the eleven (11) steps that are involved and therefore used in designing a sprinkler system. Relate each of the steps to the components described above.

Q5. (a) Drip irrigation outperforms all other irrigation systems in two ways which explains why crops do best under this systems. The two ways are related to minimizing plant water stress. Explain these two ways.

(b) The Drip irrigation system has a control head. What does the control head do. Describe the control head naming each of its parts and describing what these parts do.

Q6. A farmer wants to abstract water from a nearby stream to his furrow irrigated vegetable field at a minimal cost.

a. Given that the area in question is relatively flat and on loamy soils, discuss in detail head works and conveyance system you would put in place for this purpose.

b. What factors need to be taken into consideration for the head works and conveyance system?

c. How would the farmer know how much water is conveyed to his field on a daily basis?

Figure 19

Pump characteristic curves (Adapted from Longenbaugh and Duke, 1980)

