



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF AGRICULTURAL AND FOOD SCIENCES

**THIRD YEAR FIRST SEMESTER UNIVERSITY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN HORTICULTURE AND SOIL
SCIENCE**

2016/2017 ACADEMIC YEAR

REGULAR

COURSE CODE: ALS 3328

COURSE TITLE: BIOMETRY

EXAM VENUE:

STREAM: BSc. (Horticulture/Soil Science)

DATE:

EXAM SESSION:

TIME: 2 HOURS

Instructions:

- 1. Answer ALL questions in section A and ANY other 2 Questions in section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A: COMPULSORY [30 marks]

QUESTION ONE [SIX MARKS]

- a. Define P-value in hypothesis testing [2 marks]
- b. Distinguish between a critical value and a critical region [2 marks]
- c. Define significance level [2 marks]

QUESTION TWO [SEVEN MARKS].

The quantity of a meat from a zebu bull is supposed to average 800 kg in a county. A random sample of 16 abattoirs in the county is visited, and the average mass is found to be 812. Suppose we know that the standard deviation of viscosity is $\sigma = 25$ kg.

- a. Determine the test statistic [2 marks]
- b. Determine p-value for the test [3 marks]
- c. Test these hypotheses based on p-values at $\alpha = 0.05$ [2 marks]

QUESTION THREE [EIGHT MARKS]

. Feeding time (A) and drinking water (B) were administered on some dairy goats. Two feeding times (early and late) and two temperatures of water (cold and warm) are selected. Four observations are made on each set of conditions as shown below. The response is the average milk produced each week over one month.

		Treatment	Replicate			
A	B	combination	I	II	III	IV
-	-		18.2	19	12.9	14.4
+	-		27.2	24	22.4	22.5
-	+		15.9	15	15.1	14.2
+	+		41	44	36.3	39.9

- a. Estimate the main effect [3 marks]
- b. draw the AB interaction plot [3 marks]
- c. Interpret the plot [2 marks]

QUESTION FOUR [NINE MARKS]

Three different washing solutions are being compared to study their effectiveness in retarding bacteria growth in planting bags in a green house. The analysis is done in a laboratory, and only three trials can be run on any day. Because days could represent a potential source of variability, the experimenter decides to use a randomized block design. Observations are taken for four days, and the data are shown here.

Solution	Days			
	1	2	3	4
A	13	22	18	39
B	16	24	17	44
C	15	14	21	22

- a. Identify the treatments and blocks [2 marks]
- b. Analyze the data from this experiment for:
- i. block effects (use $\alpha = 0.05$) [5 marks]
- iii. Draw your conclusions [2 marks]

SECTION B: 40 MARKS

ANSWER TWO QUESTIONS ONLY

QUESTION FIVE [20 MARKS]

- a. The shelf life of a carbonated beverage is of interest. Ten bottles are randomly selected and tested, and the following results are obtained:

108	138
124	163
124	159
106	134
115	139

We would like to demonstrate that the mean shelf life exceeds 120 days.

- i. Set up appropriate hypotheses for investigating this claim [2 marks]
- ii. Test these hypotheses using $\alpha = 0.01$ [7 marks]
- iii. What are your conclusions? [$\sigma^2 = 382$] [2 marks]
- b.i. Determine the p-value for this test [3 marks]
- ii. Draw conclusions using the P-value, comparing this with that in a. above [2 marks]
- c. Calculate the 99% confidence interval for the population mean [4 marks]

QUESTION SIX [20 MARKS]

An agronomist wishes to determine the percentage of Phosphorous in four varieties of a compound fertilizer. The results are the following:

Variety	Percentage of Phosphorous		
A	31	15	21
B	20	21	24
C	23	15	21
D	20	17	19

a. Identify the:

- i. Treatment factor in this study [1 mark]
- ii. The experimental unit [1 mark]
- iii. The response variable [1 mark]
- b. i. State the appropriate hypotheses for the experiment [2 marks]
- ii. Determine the treatment sum of squares [6 marks]
- c.i. Construct anova table for the experiment [7 marks]
- ii. Do the varieties differ significantly? Use $\alpha = 0.05$ [2 marks]

QUESTION SEVEN [20 MARKS]

The effect of five different catalysts (A, B, C, D, and E) on reaction time of a chemical process is being studied. Each batch of new material is only large enough to permit five runs to be made. Furthermore, each runs requires approximately 1 1/2 hours, so only five runs can be made in one day. The experimenter decides to run the experiment as a Latin square so that day and batch effects can be systematically controlled. She obtains the data that follow.

Batch	Day				
	1	2	3	4	5
1	A=8	B=7	D=1	C=7	E=3
2	C=11	E=2	A=7	D=3	B=8
3	B=4	A=9	C=10	E=1	D=5
4	D=6	C=8	E=6	B=6	A=10
5	E=4	D=2	B=3	A=8	C=8

a. Identify the:

- i. Treatment factor in this study [1 mark]
- ii. The experimental unit [1 mark]
- iii. The response [1 mark]
- b. i. Analyze the data from this experiment (use $\alpha = 0.05$) [7 marks]
- ii. Draw conclusions [3 marks]

c. An experiment was run on animal feeds in an effort to increase their intake. Two feeds A and B each at two values were studied. The factors and levels were A, setting [small, large], B, exposure time [20% below nominal, 20% above nominal].

Results of a replicated 2^2 design are: (1) =7, a =9, b= 34, ab = 55.

- i. State the response variable [1 mark]
- ii. Determine all possible contrasts [3 marks]
- iii. Estimate main and interaction effects [3 marks]

QUESTION EIGHT [20 MARKS]

a. In an experiment data on Tomatoes was analyzed and the results are as in the anova table shown below ($\alpha= 0.05$)

Source of variation	DF	SS	MSS	P-value
Treatment	3	1.219	0.4063	0.012
Residual	20	1.724	0.0862	

- i. State the level of the treatments under investigation [1 mark]
- ii. State the hypothesis being tested [2 marks]
- iii. Draw conclusions for the test [2 marks]

b. An animal experimenter was also interested in potential production differences resulting from the two types of animal feeds. As a measure of the amount of production, he measured the milk output of the animals fed on the two feeds. The results follow:

Feed type	Animal			
	Jane		Martha	
A	39	45	20	13
	58	35	16	11
B	44	35	13	10
	42	21	16	15

- i. Determine main and interaction effects [6 marks]
- ii. Draw the interaction plots [4 marks]
- ii. Interpret the plots [1 mark]
- c. Determine main effect sum of squares [4 marks]