

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Agricultural and Plantation Engineering



Study Programme: Bachelor of Industrial Studies Honours (Agriculture)

Name of the Examination : Final Examination

Course Code and Title : AGZ5367 Experimental Design

Academic Year : 2023/2024

Date: 22.02.2025

Time: 9.30 to 12.30hrs

Duration: 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This is an **Open Book Test**
3. Answers should be in clear handwriting.
4. Do not use red colour pen.
5. Answer **only four (04)** questions.
6. All questions carry equal marks.

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1.
 - i. Based on the lesson materials, day schools, and lab classes, how would you define the term "experimental design"? (5 marks)
 - ii. Why is learning experimental design important for a graduate in agricultural science? (5 marks)
 - iii. Explain the difference between independent variables and dependent variables. (5 marks)
 - iv. What is randomization and why it is important in designing experiments? (5 marks)
 - v. Suppose you want to conduct an experiment to determine whether feeding stray dogs significantly increases their population in common areas. Formulate the null and alternative hypothesis specifically for this experiment. (5 marks)

2. Suppose a research officer (RO) wants to compare the effect of four different S_i (S_1, S_2, S_3 and S_4) on growth of tomato seedlings in greenhouses. He plans to conduct this experiment using three different greenhouses located close to each other. However, he noted that there is a difference in the light levels among the green houses.

- i. What is the most appropriate experimental design for the above experiment and justify your answer? (3 marks)
- ii. Given below are the treatment means (kg/plant) and the MSE reported for the above experiment.

Treatment	Mean (kg/plant)
S1	26.0
S2	25.2
S3	28.0
S4	20.0
MSE	6

- iii. If the RO uses LSD method to compare all pairs of treatment means
 - a. What is the degrees of freedom for error should be looking at? (2 marks)
 - b. What is the t table value? (2 marks)
 - c. Calculate the critical LSD value for comparing means? (3 marks)
 - d. Interpret the results of the LSD test using letter notation. (5 marks)
 - iv. If the RO uses the DNMRT test to compare the means
 - a. Calculate the DNMRT critical value. (2 marks)
 - b. Interpret the results of the DNMRT test using letter notation. (3 marks)
 - v. If the RO is interested to compare the means of the treatments 1, 2 and 3 with the mean of treatment 4,
 - a. Which mean comparison method will be the most suitable? (2 marks)
 - b. Compare means using the proposed procedure in (a) and interpret the results using letter notations. (3 marks)
3. Consider a field experiment where you want to test two varieties of tomatoes in three different irrigation frequencies.
- i. Which experimental design is suitable for this field experiment? (5 marks)
 - ii. Justify the selection of the above design. (4 marks)
 - iii. How many replicates would you propose for this experiment? (4 marks)
 - iv. Write the statistical model for ANOVA for above experiment. (2 marks)
 - v. Construct the ANOVA table for the above experiment (sources of variation and degree of freedom only) (10 marks)

4. The effect of three feed compositions (A, B, and C) on the honeybee production were investigated using three different bee types and three different feeding methods. The honey gain was measured in terms of millilitres per plot and the collected data are given below. Honey gain (ml/plot)

Feeding method	Honey gain (ml/plot)		
	Bee type 1	Bee type 2	Bee type 3
1	85 (B)	40 (A)	65 (C)
2	55 (A)	62 (C)	80 (B)
3	48 (A)	90 (B)	68 (C)

- What is the most suitable design for this experiment? (3 marks)
- State the hypothesis for the experiment. (2 marks)
- Write the statistical model for the experiment and explain all the terms. (2 marks)
- Construct the ANOVA table. (8 marks)
- Test the hypotheses at 95% level of confidence and clearly state the findings. (5 marks)
- Using DNMRT test, compare the means for their significance using letter notations and interpret the results. (5 marks)

5.

A researcher conducts a study to examine the relationship between a student's class standing and the number of times a student visits the faculty medical officer during an academic year. Given below the responses of a random sample of 300 students employed in the study.

Year of Study	Number of visits			Row sums
	0 visits	1 – 5 visits	More than 5 visits	
First	20	16	24	60
Second	30	14	15	59
Third	50	32	12	94
Final	25	12	50	87
Column sums	125	74	101	300

- Write down the hypothesis to be tested. (5 marks)
- What are the independent variable and the dependent variable of the study? (2 marks)
- Calculate the expected values of the observations. (10 marks)
- What are the degrees of freedom and the Chi-Square value at the 5% level of significance for testing the hypothesis? (3 marks)
- If the calculated Chi Square value is 45.07, test the hypothesis and interpret the results. (5 marks)

- 6.
- i. Suppose you want to examine the effects of three different potassium levels on two chili varieties.
 - a. Which statistical design would be the most suitable for testing the effects? (2 *marks*)
 - b. List one advantage of experimental design chosen here. (3 *marks*)
 - ii. Display the following two situations using the appropriate graphs. (5 *marks*)
 - a. An interaction between planting variety and potassium level
 - b. No interaction between planting variety and potassium level
 - iii. Give the statistical model for the ANOVA for the experiment described in **i(a)** assuming the treatments are arranged in a randomised complete block design with 3 replicates (5 *marks*)
 - iv. Consider the following 3x2 factorial experiment where treatments are arranged in a CRD. Calculate the SSs, construct the ANOVA table and interpret results. Consider that the correction factor and the total sum of squares have been already calculated as 22401.39 and 1911.61. (10 *marks*)

Treatment combinations	Replicates		
	1	2	3
K_1V_1	23	18	21
K_1V_2	25	29	23
K_2V_1	28	36	38
K_2V_2	53	50	48
K_3V_1	45	41	40
K_3V_2	39	36	42