

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 : 2020/2021

Date: 20.02.2022

Time: 14.00 to 17.00hrs

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. This question paper consists of **six (06)** question in **four (04)** pages.
6. Answer **only five (05)** questions.
7. All questions carry equal marks.

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1. Consider that you were asked to compare **five (05)** varieties of tomato according to the yield and you have facilities only to conduct a pot experiment.
    - a. What is the most convenient type of the experimental design you would select for above said study? *(5 marks)*
    - b. What is the error degrees of freedom (*df*) should you try to maintain in the above experiment? *(5 marks)*
    - c. Calculate the number of replicates you would select if you wanted to maintain above level of error *df*? *(5 marks)*
    - d. Draw the experimental layout as per your selected design and the number of replicates. *(5 marks)*

2. The following experimental layout was obtained from an experiment to test **four (04)** fertilizer levels (F).

F1R1	F1R4	F1R5	F2R4	F3R5
F4R2	F3R1	F1R3	F4R1	F3R4
F1R2	F3R3	F4R5	F2R2	F2R5
F2R2	F2R1	F2R3	F4R4	F4R3

- a. Identify the design and justify your answer. *(2 marks)*  
 b. Suppose the yield (kg/ha) obtained from each experimental unit is given as below.

T1R1	4.12	T2R1	4.87	T3R1	5.75	T4R1	6.75
T1R2	4.31	T2R2	5.00	T3R2	6.31	T4R2	6.84
T1R3	3.98	T2R3	5.32	T3R3	6.53	T4R3	7.53
T1R4	3.78	T2R4	5.65	T3R4	5.10	T4R4	5.67
T1R5	3.00	T2R5	5.71	T3R5	5.32	T4R5	5.82

Redraw the layout given above with the yield values as per the treatment layout given above. *(2 marks)*

- c. Write down the hypothesis to be tested. *(2 marks)*  
 d. Calculate the CF, overall mean, SS-treatment, SS-total and SS-error. *(4 marks)*  
 e. Prepare the ANOVA table, test the hypothesis and interpret the results. *(2 marks)*  
 f. Compare the treatment means using t-statistics. *(4 marks)*  
 g. Suppose that the above experiment has to be conducted in a field with a moisture gradient.  
     i. What is the design would you propose? *(2 marks)*  
     ii. Draw the layout for the proposed design. *(2 marks)*
3. Consider a field experiment with **four (04)** treatments. These treatments have to be arranged in a field where you find the variability along the field as well as across the field.
- a. Which experimental design is suitable for this field experiment? *(4 marks)*  
 b. How many replicates would you propose for this experiment? *(4 marks)*  
 c. Using an appropriate randomization procedure allocate the treatment into plots. All the steps in randomization process should be explained. *(12 marks)*

4. In an experiment with **four (04)** treatments conducted in a RCBD with 5 blocks, the following output has been obtained

Treatment means

$$\bar{y}_1 = 26.0 \quad \bar{y}_2 = 25.2 \quad \bar{y}_3 = 28.0 \quad \bar{y}_4 = 20$$

$$MS_e = 6.0$$

- Use the LSD and DMRT methods for comparing all pairs of means and interpret the results using letter notations. *(5 marks)*
  - If Y1 is the control and all other treatments have to be compared with the control what is the best suited mean comparison test for this experiment? *(3 marks)*
  - Compare means using the proposed procedure and interpret the results using letter notations. *(5 marks)*
  - Compare and comment on the results obtained in each mean comparison technique. *(7 marks)*
5. Consider the following results of an experiment designed to test four varieties of tomato. The values are average yield of a plant in kilograms.

Variety	Replicates			
	1	2	3	4
1 (traditional)	1.8	2.0	2.1	2.4
2 (local hybrid)	1.9	1.8	2.1	2.3
3 (exotic hybrid 01)	3.1	3.2	2.8	3.0
4 (exotic hybrid 02)	2.9	3.1	3.0	3.3

- Develop **two (02)** sets of contrasts to compare traditional variety vs. hybrid varieties and local hybrid variety vs exotic hybrid varieties (01 and 02) and confirm that they are orthogonal. *(5 marks)*
- Construct the ANOVA for the two contrasts and interpret the results. *(15 marks)*

6. Consider the following 3x2 factorial experiment where treatments are arranged in a CRD.

Treatment combinations	Replicates		
	1	2	3
$F_1V_1$	2.3	1.8	2.1
$F_1V_2$	2.5	2.9	2.3
$F_2V_1$	2.8	3.6	3.8
$F_2V_2$	5.3	5.0	4.8
$F_3V_1$	4.5	4.1	4.0
$F_3V_2$	3.9	3.6	4.2

- Calculate the SSs, construct the ANOVA table and interpret results. (4 marks)
- Estimates the main effects and interaction effect and interpret the results. (4 marks)
- Compare all means of treatment combinations using DMRT and prepare the table with letter notations. (4 marks)
- Compare means of fertilizer at each variety and compare the pares of treatments at each fertilizer level using t-test. (4 marks)
- Compare the results with the results obtained in the part "c" (4 marks)