College of Agricultural engineering sciences
Department of Horticulture
Salahaddin University-Erbil

Agricultural Experimental Design and Analysis
Unit Guide
Undergraduate Third Year

First Semester, 2024-2025

Course Book

1. Course name	Agricultural Experimental Design and Analysis
2. Lecturer in charge	Dr. Noura Masseh Ellya Kka
3. Department / College	Department of Horticulture/ Agricultural engineering sciences
4. Contact	Email: noura.kka@su.edu.krd
5. Time (in hours) per week	Theory: 2 h/w Monday 8:30-10:30am, Practical: 2h /w Monday 12:30-02:30 pm
6. Office hours	I am usually available after class (Wednesday from10:30 am to 12:00 pm) or you can arrange an appointment. It is best to email me to set up a meeting time. Please use my direct email address for this purpose.
7. Course code	AgH1304
8. Teacher's academic profile	**Academic background** **Doctor of Philosophy**, 2017, Deakin University, Geelong, Australia https://academics.su.edu.krd/noura.kka
9. Keywords	One - Factor (simple) and more than one factor (factorial) experiments, one-way ANOVA, Two- way ANOVA, Multiple range tests.

10. Course overview:

The basic principles of Experimental Design and Analysis will be examined in this unit and topics covered will span the concepts and examples of experimental Design. This unit will cover simple and factorial experiments, one-way ANOVA, complete randomize design (CRD), Randomized Complete Block (RCB), missing data, Latin square (LS). Additionally, students will develop skills relevant to research area.

11. Course objective:

This unit has been specifically designed to examine both the fundamental and applied aspects of experimental design and analysis and will be valuable for students studying a variety of courses, especially within Agriculture, Horticulture, Forestry, Food technology, Plant pathology, Zoology and Biology. The basic principles of Experimental Design and Analysis will be examined in this unit and topics covered will span the concepts and examples of experimental Design, Additionally, students will develop laboratory and field trail techniques/skills relevant to botany research, in a group environment, and ascertain how research projects are undertaken in this discipline.

12. Student's obligation

Attendance

Attendance for this class is mandatory. Attendance will be confirmed with evaluation sheets. Each unexcused absence will result in the lowering of your final grade by one grade.

Academic Honesty and Integrity

Cheating of any kind will not be tolerated. Copying of others' work, use of disallowed material, plagiarism in assignments, or cheating in any other form as defined by the instructor will result in a grade of zero for that assignment. Multiple infractions will result in a grade of 'Fail' for the course.

Student Conduct

Students are expected to respect the rights of others in the class. Cell phones and other electronic equipment should be turned off prior to the beginning of class. Use of these items during class time, or any other unwarranted classroom disruption, will result in your immediate excusal from class for the remainder of the period.

You may bring drinks to class. Please finish any meals before class begins. The use of tobacco products during class time is strictly prohibited.

13. Forms of teaching

Lectures (Teaching by presentation), classroom teaching (class discussion),

Integrating Technology (Google Classroom, electronic mail)

Case Method (field work, laboratory work and excursions): Providing an opportunity for students to apply what they learn in the classroom to real-life experiences.

English is the main language for teaching in addition to Arabic and Kurdish.

14. Assessment scheme

Theory	Percentage of Overall Mark
10 x pre-quizzes	5%
First midterm test	5%

- Monday   7 October from 8:30 -9:30 am
- Covers topics up to Analysis of Variance (ANOVA) (Week 1 to Week 3).

Second midterm test	5%

- Monday the 4th   of November from, 8:30 -9:30 am
- Covers topics up to Comparison of Multiple treatment means Other Mean Comparisons (Week 4 to Week 7).

Practical	
10 x pre-quizzes	5%
First midterm test	5%

- Monday the 14th of October, 12:30 -01:30 am
- Covers topics of (Week 1 to Week 3).

Second midterm test	5%

- Monday the 11th of November, 12:30 -01:30 am
- Covers topics of (Week 4 to Week 7).

Conducting a practical experiment including Report or Presentation	**20%**

Final Exam (Week 1 – Week 12)	
Theory	50%
TOTAL	100%

 To obtain a pass in the unit, students must submit the practical class assessments, and pass the two theoretical and practical tests during semester.

15. Student learning outcome:

Students will be able to:

1. Describe the major characteristics of a scientific experiment.

2. Calculate variance and standard deviation from a data set.

3. Perform ANOVA to determine whether means are significantly different.

4. Explain the difference between CRD, RCB, and LS

5. Be able to select and plan the correct design to conduct experiments in the laboratory, greenhouse and field.

16. Course Reading List and References:

1. Glaz, B., & Yeater, K. M. (Eds.). (2018). Applied Statistics in Agricultural, Biological, and Environmental Sciences. American Society of Agronomy, Inc., Soil Science Society of America, Inc., Crop Science Society of America, Inc. DOI: 10.2134/appliedstatistics

2. Keough, M.J., *Experimental Design and Data Analysis for Biologists*. 2002, Cambridge, Cambridge University Press.

3. Pernille, C., *An Introduction to Statistical Methods and Data Analysis (6th ed., international ed.).* Journal of Property Investment & Finance, 2011(2): p. 227.

4. Oehlert, G.W., *A first course in design and analysis of experiments*. 2010.

5. Cox, D.F., *Statistical Procedures for Agricultural Research (Book).* Journal of the American Statistical Association, 1985. 80 (390): p. 486.

6. Clewer, A.G. and D.H. Scarisbrick, *Practical statistics and experimental design for plant and crop science*. 2013: John Wiley & Sons.

7. Graham, J.W., *Missing data. [electronic resource] : analysis and design*. Statistics for social and behavioral sciences. 2012: New York, NY : Springer, c2012.

17. The Topics:			Lecturer's name

Week	Week commences	Class topics	Assessment tasks
1	6 September	Experimental Principles [1] Basic Statistics	Pre quiz 1 week 1
2	13 September	Hypothesis Testing [2] Comparisons of Two Means	Pre quiz 2 week 2
3	20 September	Analysis of Variance (ANOVA) [3]	Pre quiz 3 week3
4	27 September	Experiments with a Single Factor: **(Test 1)**	Pre quiz 4 week 4
5	4 October	Completely Randomized Design (CRD) [4]	Pre quiz 5 week 5
6	11 October	Comparison of Multiple treatment means Other Mean Comparisons [5]	Pre quiz 6 week 6
7	18 October	Randomized Complete Block (RCB) Design	Pre quiz 7 week 7
8	25 October	Missing data [6]	Pre quiz 8 week 8
9	1 November	Latin Square (LS) **(Test 2)**	Pre quiz 9 week 9
10	8 November	Relative Efficiency	Pre quiz 10 week 10
11	15 November	Introduction to Factorial Designs	Pre quiz 11 week 11
12	22 November	Three-or-more-factor experiment	
13	29 November	Split-Plot Designs **(Test 3)**	
14	6 December	Review	
Class content may change slightly and classes may overlap			

18. Practical Topics (If there is any)	
Same topics as theory in addition to detailed examples for each design and test.	Dr. Noura Kka From September 7- December 7 2023 Every Monday from 12:30 am -02:30 pm excluding public holidays

19. Examinations:

Q / Define the following terms and give an example of an item that illustrates your definition.

Treatments, Experimental unit, Responses.

Q/ Fill in the Blank

1- If we ………… H_0 when H_0 is true, we commit a …………… .
2- If we …………… H_0 when H_0 is false, we commit a Type II error.
3- The results are statistically ……………… - when p−value < α
4- The results are ………………………… - when p−value > α

Q/ what are the Advantages and Disadvantages of completely randomized designs?

Q/ Match the following with the items below

μ, $i=1,2,3,\ldots\ldots$, $L.S.D_\alpha =$, $\varepsilon_{ij} =$, L.S.R, $j=1,2,3,\ldots\ldots$, D_{Dunnett}, Yij, $\tau_i = \bar{Y}i. - \bar{Y}.. =$, k_o

t
Treatment effect
$= value$ of any experiment unit
$= \dfrac{1}{t-1}\left(\sum r_i - \dfrac{\sum r_i^2}{\sum r_i} \right)$
$\bar{Y}.. =$ mean of a population
$t_{\text{Dunnett}_{(\alpha,df_t,df_E)}} \times \sqrt{\dfrac{2MSE}{r}}$
$= S\bar{X} \times SSR$
$Yij - \bar{Y}i. = Error$
r
$t_{(\alpha,df_E)} \times \sqrt{\dfrac{2MSE}{r}}$

Q/ To compare four different sources of spinach seeds and it is effect on the dry matter yield. An experiment was conducted in a field. The plots were furrow irrigated and there was a line of trees that might form a shading gradient. What Design was applied? Draw a sample layout of the randomization of this experiment? Write the liner model of the experiment?

A	C	D	B
C	D	B	A
A	B	A	D
B	C	D	C

Q/ The following layout experiments belong to which design? Write the mathematical model for each design.

A	D	C	C
D	A	D	B
C	B	A	D
B	C	B	A

A	B	D	C
C	D	A	B
B	A	C	D
A	D	B	C

20. Extra notes:

Please feel free to come and talk to me to get helpful feedback on your progress, or if you are struggling in any way.

This course book provides you with the key information about Experimental Design and Analysis.

For the best chance of success, you should read it very carefully and refer to it frequently throughout the semester.

21. Peer review

Standard guidelines were followed, and it is clear.

- There are sufficient topics and examples.
- References are relevant, recent and available.