Department of (Statistics)

College of (Administration and Economics)

University of Salahaddin - Erbil

Subject: Experimental Design and Analysis

Course Book – (Year 4)

Lecturer's name: Dr. Akhterkhan Saber Hamad

Academic Year: 2017/2018

Course Book

1. Course name	**Experimental Design and Analysis**
2. Lecturer in charge	**Dr. Akhterkhan Saber Hamad**
3. Department/ College	**Statistics/ Adm. & Eco.**
4. Contact	**e-mail:Akhterkhan.hamad@su.edu.krd** **Tel: (07504553025)**
5. Time (in hours) per week	**Theory: 2 , Practical: 1**
6. Office hours	**3**
7. Course code	
8. Teacher's academic profile	**1993 : B.Sc : Statistics/ collage of Adm. & Eco. in Salahaddin university.** **2000 : M.Sc : Statistics/ collage of Adm. & Eco. in Salahaddin university.** **2010 : PhD : Statistics/ collage of Adm. & Eco. in Sulaimani university.**
9. Keywords	**Experimental Design, Regression , Biostatistics, Operation Research, Computer Applications,Matrix,Sampling,) anddoing researches as well**

10. Course overview:

In this section the lecturer shall write an overview about the subject he/she is giving. The course overview must cover:

- The importance of studying the subject
- Understanding of the fundamental concepts of the course
- Principles and theories of the course
- A sound knowledge of the major areas of the subject
- Sufficient knowledge and understanding to secure employment

This should not be less than 200 words

A branch of statistics that attempts to outline the way in which experiments should be carried out so the data gathered will have statistical value.In the design of experiments, the experimenter is often interested in the effect of some process or intervention (the "treatment") on some objects (the "experimental units"), which may be people, parts of people, groups of people, plants, animals, materials, etc. Design of experiments is thus a discipline that has very broad application across all the natural and social sciences.

11. Course objective:

This should not be less than 100 words

Purposes and Objectives of the Course

The topic of the course is applied Experimental Design. Key features are:

1. The topics of design and analysis will be studied together. The idea behind this approach is that to choose an appropriate design it is necessary to understand the properties of the anticipated data analysis.

2. The emphasis will be on applications, rather than theory.

3. Applications in the agricultural, biological, ecological, and medical sciences will be emphasized, rather than applications in manufacturing or business.

4. Most statistical computations in this course will be done in Minitab.

Entry requirements

- Skill of working with computer
- Skill of working with SPSS Application

12. Student's obligation

In this section the lecturer shall write the role of students and their obligations throughout the academic year, for example the attendance and completion of all tests, exams, assignments, reports , essays…etc

لێرە مامۆستا بەرپرسیارێتی قوتابی خوێندکار ڕووندەکاتەوە سەبارەت بە کۆرسەکە بۆ نموونە ئامادەبوونی قوتابیان لە وانەکاندا، لە تاقیکردنەوەکاندا، ڕاپۆرت و ووتار نووسین... هتد.

Exams, and Assignments

13. Forms of teaching

لێرە مامۆستا ڕێگەی وانە ووتنەوە دەنووسێت، بۆ نموونە: داتاشۆ و پاوەرپۆینت، سەر تەختەڕەش، تەختەی سپی، سمارتبۆردیان مەلزەمە... هتد

Data show, whiteboard

14. Assessment scheme

Breakdown of overall assessment and examination

لێرە مامۆستا جۆری هەڵسەنگاندن (تاقیکردنەوەکان یان ئەزموونەکان) دەنووسێت بۆ نموونە تاقیکردنەوەی مانگانە، کویزەکان، بیرکردنەوەی ڕەخنەگرانە (پریزەنتەیشن)، ڕاپۆرت نووسین، ووتار نووسین یان ئامادەنەبوونی خوێندکار لە پۆلدا...هتد. ئامانە چەند نمرەی لەسەردەبێت و مامۆستا چۆن نمرەکان دابەشدەکات؟

Two examination season and Activity daily.

15. Student learning outcome:

پرکردنەوەی ئەم خانەیە زۆر گرنگە، مامۆستا دەرئەنجامەکانی فێربوون دەنووسێت. بۆ نموونە:ڕوونی ئامانجە سەرەکیەکانی کۆرسەکە (بابەتەکە) بۆ خوێندکار
گونجاندنی ناوەڕۆکی کۆرسەکە بە پێویستی دەرەوە و بازاڕی کار
قوتابی چی نوێ فێردەبێت لە ڕێگەی پێدانی ئەم کۆرسەوە؟

This should not be less than 100 words

Teaching students the philosophy of all design with the mathematical model and manual analyzing and application through SPSS.

16. Course Reading List and References:

▪Key references:[1234]

1. Federer, W. T., Experimental design. *Experimental design*. 1955.
2. Kirk, R. E., *Experimental design*. Wiley Online Library: 1982.
3. Winer, B. J.; Brown, D. R.; Michels, K. M., *Statistical principles in experimental design*. McGraw-Hill New York: 1971; Vol. 2.
4. Box, G. E.; Hunter, J. S.; Hunter, W. G., Statistics for experimenters: design, innovation, and discovery. *AMC* 2005, *10*, 12.

▪Useful references:

(الراوي ، خاشع محمود وعبد العزيز محمد خلف الله. 2000. تصميم وتحليل التجارب الزراعية. كلية الزراعة والغابات. جامعة الموصل – العراق)

▪Magazines and review (internet):

(Google Scholar)

17. The Topics:	Lecturer's name
In this section the lecturer shall write titles of all topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture Each term should include not less than 16 weeks	Lecturer's name ex:(2 hrs)
18. Practical Topics (If there is any)	
In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture	Lecturer's name ex: (3-4 hrs)

Week	Topics	References
1,2, 3,4	Preliminaries • General Goals of Experimental Design and some definition • Experiment, Replication, Treatment, Experimental unit, Factor, Experimental error • Design structure and treatment structure • Analysis of variance, Ideal Conditions (assumptions) • Basic Principles of Experimental Design/(Data transformation)	Chapter1
5,6, 7,8	Completely Randomized Design(CRD) • Completely Randomized Design Definitions • Principles and Usage • Lay out of Experiment • Liner model • Data Analysis/ (one-way ANOVA Table) • Advantages/Disadvantages • Multiple Mean Comparisons • Type of Models (Fixed or Random) • Completely Randomized Design under unequally replication • Liner model • Data Analysis/ (one-way ANOVA Table) • Multiple Mean Comparisons	Chapter2
9,10, 11,12	Complete Randomized Block Design (CRBD) • Completely Randomized Block Design Definitions • Principles and Usage • Lay out of Experiment (One-way Blocking) • Liner model • Data Analysis /(ANOVA Table) • Advantages/Disadvantages • Missing Value & Relative of Efficiency (%RE) • Multiple comparisons	Chapter3
13,14, 15,16, 17	Latin Square Design(LS) Latin Square Design Definitions • Principles and Usage • Lay out of Experiment (Two-way Blocking) • Liner model • Data Analysis (multi-way ANOVA) • Missing data& Relative of Efficiency (%RE) Greek Latin Square Design(GLS) • Lay out of Experiment • Liner model ,(ANOVA Table)	Chapter4
18,19, 20,21	Factorial experiments • Some Definition and Symbol • Two-way experiments • three-way experiments • Advantages/Disadvantages • Factorial experiments using completely randomized design	Chapter5

	• Lay out of Experiment • Liner Models • Data Analysis (ANOVA Table) • Multiple comparisons for factorial experiments • Factorial experiments using complete randomized block design • Lay out of Experiment • Liner Models • Data Analysis (ANOVA Table) • Factorial experiments using Latin square Design • Lay out of Experiment • Liner Models • Analysis of variance(ANOVA Table)	
22,23, 24,25	Confounding • Confounding Definitions • Principles and Usage • Layout of Confounding in 2*2 experiment • Layout of Confounding in 2*3 experiment • Complete Confounding • Partial Confounding • Examples	Chapter6
26,27, 28	Split-plot design • Split plot design Definitions • Principles and Usage • whole plot • Sub plot • Liner Model and Assumptions when whole plot experiment is Completely Randomized Design. • Liner Model and Assumptions when whole plot experiment is Completely Randomized Blocked • Analysis of variance on whole plot and sub-plot, • Multiple comparisons • Example	Chapter7
29,30	Analysis of Covariance • Analysis of Covariance Definitions • Principles and Usage • Lay out of Experiment • Models and one-way analysis of covariance in completely randomized design • Examples	Chapter8

19. Examinations:

1. Compositional: In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?
With their typical answers
Examples should be provided

2.True or false type of exams:

In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. Examples should be provided

3. Multiple choices:

In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase.Examples should be provided.

Create the design and find the Linear Model for:

1- 2^3 confounding 2blocks and 3repleaction.
2- Split Design (RCBD) (3×5) and r=2.

Test the hypotheses with 5 steps at alpha5%:

Row	Column 1	Column 2	Column 3	Column 4	Row $(\sum R)$
1	1.640 (B)	1.210 (D)	1.425 (C)	1.345 (A)	5.620
2	1.475 (C)	1.185 (A)	1.400 (D)	1.290 (B)	5.350
3	1.670 (A)	0.710 (C)	1.665 (B)	1.180 (D)	5.225
4	1.565 (D)	1.290 (B)	1.655 (A)	0.660 (C)	5.170
Column total $(\sum C)$	6.350	4.395	6.145	4.475	21.365

From the ANOVA table below (LSD Latin Square Design) find the relative efficiency of RE (LSD: RCBD) and RE (LSD: CRD) and discuss (ناقش) the results:
(15 Degrees)

S.O.V.	d.f.	SS
Row	3	0.030
Column	3	0.827
treatments	3	0.427
Error	6	0.129
Total	15	1.413

$$R.E._{(LD:CRD)} = \frac{MS_{Row} + MS_{Col.} + (r-1)MS_E}{(r+1)MS_E} \times 100 \qquad R.E._{(LD:RCBD_{Row})} = \frac{MS_{Col.} + (r-1)MS_E}{rMS_E} \times 100$$

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review پێداچوونەوەی هاوەڵ

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).

ئەم کۆرسبووکە دەبێت لەلایەن هاوەڵێکی ئەکادیمیەوە سەیر بکرێت و ناوەرۆکی بابەتەکانی کۆرسەکە پەسەند بکات و جەند ووشەیەک بنووسێت لەسەر شیاوی ناوەرۆکی کۆرسەکە و واژووی لەسەر بکات.

هاوەڵ ئەو کەسەیە کە زانیاری هەبێت لەسەر کۆرسەکە و دەبیت پلەی زانستی لە مامۆستا کەمتر نەبێت.