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**Department of Animal Resources**

**College of Agriculture**

**University of Salahaddin–Erbil**

**Subject: (Adv. BioStatistics)**

**Course Book – Third Class**

**Lecturer's name: - Assist Prof.Dr. Mohammed sulaiman (Ph.D)**

**Academic Year: 2023/2024**

**Course Book**

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| **1. Course name** | **Experimental Design and Analysis** |
| **2. Lecturer in charge** | **Mohammed Sulaiman Abdullah** |
| **3. Department/ College** | **Agriculture College/Animal Resources Department** |
| **4. Contact** | **e-mail:**  **Tel: (07504686486)** |
| **5. Time (in hours) per week** | **Theory : 2 hours**  **Practical: 3 hours** |
| **6. Office hours** | **Available all days during the week** |
| **7. Course code** |  |
| **8. Teacher's academic profile** | **B.ch. In animal production -2001**  **M.sc. In poultry breeding -2007**  **Ph.D in Poultry Breeding -2020** |
| **9. Keywords** | **statistics , treatments , Design , Experimental unit , Experimental error , experiment design ,** |
| **10. Course overview:**  **Introduction :**  **Ronald A. Fisher** developed basic principles of design and analysis from 1919 to 1933 at Rothamsted Experimental Station, England  • The Arrangement of Field Experiments (Fisher, 1926)”, he outlined and advanced three fundamental components for experiments in agricultural trials: Local control, Replication and Randomization  • Statistical Principles for Research Workers (Fisher, 1925)  • The Design of Experiments (Fisher, 1935).  Much of Fisher‘s contributions to statistics were based on biological data from Rothamsted. Fisher invented the techniques **of maximum likelihood and analysis of variance (F-test),** was a pioneer in the design of experiments, and originated the concepts of sufficiency, ancillarity, and Fisher information score, making him a major figure in 20th century statistics. | |
| **11. Course objective:**   * The course is designed to expose students to the following fields in experimental design: * 1. Exp. Design Identification * 2. Analysis of Variance: CRD, RBD, Latin, and Split Plot Designs * 3. Treatment Arrangements * 4. Post ANOVA Tests and Calculations * 5. Analysis of Covariance * 6.Develop the student’s ability in how to collect, analyze data statistically and discuss their results. | |
| **12. Student's obligation**  The students should be obligated attendance and completion of all tests, exams, quizzes, assignments, reports , essays…etc | |
| **13. Forms of teaching**  1- PowerPoint. 2- Whiteboard | |
| **14. Assessment scheme**   * **Examinations:-** * 1st exam. After 5 lectures * 2nd exam. After 10 lectures   **Mark Distribution**  **Monthly Exam 40 %( Theoretical 25% + Practical 15%)**  **Final Exam 60% (Theoretical 40% + Practical 20%) = Final**  **Mark 100%.** | |
| **15. Student learning outcome:**   * **A) knowledge and understanding:**   a. Basic concepts of statistical models and use of samples  b. Review analysis of variances and experimental designs  **B) Intellectual skills (cognitive and analytical):**  a. Achieve maximum power and benefits from designing experiments.  b. Ability to interpret results efficiently   * **C) Subject specific skills:**   a. Design of experiments and use to analyse experiments and ability to emphasis b.. Data analysis and interpretation | |
| **16. Course Reading List and References‌:**   1. Experimental Design and Analysis (Arabic), K.M. Al-Rawi. 2. Biostatistics for Animal Science, 2004. Miroslav \kaps & William R. Lamberson. | |
| **17. The Topics:** | |

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| **Weekly Lectures schedule** | | | |
|  | ***subjects*** | ***weeks*** |  |
|  | **1. Exp. Design Identification**  **Experiment , Design , Analysis , Analysis of Variance, Experimental unit , Treatments , experimental error**   1. **Basic Principles of Experimental Design .**   **Randomness , Replications , local Control** | **1st week** | 1 |
|  | **The Completely Randomized Design (C.R.D) Definition, Advantages and Disadvantages .**  **At : equal number of replication**  **b- Unequal number of replication.**  **Linear Model**  **Analysis of Variance Table (ANOVA)**  **Test of Hypotheses**  **Linear Model to any design**  **ANOVA Table** | **2nd week** | 2 |
|  | **. Estimation of Variance Components**  **Tests Suggested after Experimentation**   1. **Comparison all treatments with Control** 2. **Dunnett test** 3. **Multiple Comparisons .** 4. **LSD test**   **b-Duncans Multiple Range test** | **3rd and 4th weeks** | 3-4 |
| **The Completely Randomized Design (C.R.D) Definition, At : Unequal number of replication** | **5th week** | 5 |
|  | **Randomized Complete Block Design (R.C.B.D)**  **1- introduction , Advantages (R.C.B.D) and Disadvantages .** | **6th week** | 6 |
|  | **Relative Efficiency of R.C.B.D Compared with C.R.D**  **Missing Values for CRD** | **7th week** | 7 |
|  | **Latin Square Design (L.S.D) .**  **Introduction. advantages and disadvantages** | **8th week** | 8 |
|  | **Relative Efficiency of R.C.B.D with L.S.D**  **Relative Efficiency of C.R.D with L.S.D**  **Missing Values** | **9th week** | 9 |
|  | **Factorial Experiments conducted in C.R.D** | **10th week** | 10- |
|  | **A- Two factors A\*B (2\*3)**  **B-Three factors A\*B\*C (2\*2\*3) .** | **11th-12th weeks** | 11-12 |
|  | **Factorial Experiments conducted in R.C.B.D** | **13-14th weeks** | 13-14 |
|  | **Mutiple Questions** | **15th week** | 15 |

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| **18. Examinations:**  **Sample of questions in Experimental Design and Analysis – Animal Resources Department**  **Q1. Define: treatments, Design , Replication , Experimental Unit and Experimental error ?**  **Q2. Write advantage and disadvantages of CRD?**  **Q3/ A /** Calculate missing value and write Linear model from the following data ?   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Treatments | R1 | R2 | R3 | R4 | | T1 | 8 | 7 | ….. | 5 | | T2 | 7 | 6 | 3 | 7 | | T3 | 9 | 4 | 4 | 6 |   B/ calculate ANOVA table and write linear model ?   |  |  | | --- | --- | | Treatments | Observations ( yij) | | T1 | 4 , 8 , 9 | | T2 | 10 , 8 , 6 , 9 | | T3 | 3 , 5 , 7 , 6 , 9 |   **Q4 /** from the following data , calculate ANOVA table and find RE % as compared to C.R.D?:   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | C1 | C2 | C3 | C4 | | R1 | t3 7 | t2 5 | t1 2 | t4 10 | | R2 | t4 11 | t3 8 | t2 6 | t1 3 | | R3 | t1 2 | t4 12 | t3 7 | t2 5 | | R4 | t2 6 | t1 3 | t4 12 | t3 8 | |
| **19. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**  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).* |