Course Title: Experimental Design
Course Code: STAT 337
Program: Statistics
Department: Statistics and Operations Research
College: Sciences
Institution: King Saud University
Version: 2
Last Revision Date: 15-03-2024

Course general Description:

The course contains a various topics and techniques of Data Analysis using statistical software.

- **Introduction**: Some typical applications of experimental design, basic principles, guidelines for designing experiments, and using statistical techniques in experimentation.
- **Statistical inference:** about the differences in means, randomized designs, and about the variances of normal distributions.
- Experiments with a Single Factor (Completely Randomized Design CRD): (The Analysis of Variance):
  - Fixed and random effect model with balance and unbalance data.
  - Contrasts and Multicomparisons among treatment means (Tukey, LSD Fisher, Dunnett , Scheffe, Bonferroni).
  - determining Sample Size.
- Randomized Blocks, Latin Squares.
  - The Randomized Complete Block Design (RCBD).
  - The Latin Square Design.
  - Balanced Incomplete Block Designs (BIBD)
- Introduction to Factorial Designs.
  - The Two-Factor Factorial Design
  - The General Factorial Design.
- The 2k Factorial Design
  - The 22 Factorial Design
  - The 23 Factorial Design
- Regression and Analysis of Covariance

Course Main Objective(s):

Students after completing the course will have:

- Ability to use and integrate statistical techniques in any scientific inquiry.
- Providing the student with the skill in choosing the appropriate design to carry out the experiment.
- Understanding how to select the best methods to analysis data by using statistical packages.
- Ability to give right interpretations of statistical results.
- The skills to prepare and write statistical reports.

Course Content

W	List of Topics	Text book
1	**Introduction**: Some typical applications of experimental design, basic principles, guidelines for designing experiments, and using statistical techniques in experimentation.	**CH1 (1.1 – 1.4)**
	Experiments with a single factor: Analysis of variance	**CH.3**
2	3.1 AN EXAMPLE 3.2 THE ANALYSIS OF VARIANCE 3.3 ANALYSIS OF THE FIXED EFFECTS MODEL 3.3.1 Decomposition of the Total Sum of Squares 3.3.2 Statistical Analysis 3.3.3 Estimation of the Model Parameters 3.3.4 Unbalanced Data	**CH3 (3.1 – 3.3)**
3	**Model Adequacy Checking** 3.4.1 The Normality Assumption 3.4.2 Plot of Residuals in Time Sequence 3.4.3 Plot of Residuals Versus Fitted Values 3.4.4 Plots of Residuals Versus Other Variables	**CH3 (3.4.1– 3.4.4)**
4	**Estimation methods for regression coefficients** 3.5.1 A Regression Model 3.10.1 Least Squares Estimation of the Model Parameters 3.10.2 The General Regression Significance Test	**CH3 (3.5.1, 3.10)**
5	**Estimating missing observations**	
6	**Comparison testing** 3.5.2 Comparisons Among Treatment Means 3.5.3 Graphical Comparisons of Means 3.5.4 Contrasts 3.5.5 Orthogonal Contrasts 3.5.6 Scheffe's Method for Comparing All Contrasts 3.5.7 Comparing Pairs of Treatment Means 3.5.8 Comparing Treatment Means with a Control	**CH3 (3.5.2– 3.5.8)**
7	**1st midterm**	
8	**The Randomized Complete Block Design (RCBD).** 4.1.1 Statistical Analysis of the RCBD 4.1.2 Model Adequacy Checking 4.1.3 Some Other Aspects of the Randomized Complete Block Design 4.1.4 Estimating Model Parameters	**CH. 4 (4.1.1-4.1.4)**
9	**The Latin Square Design.**	**CH. 4 (4.2)**
	4.4 Balanced Incomplete Block Designs (BIBD) 4.4.1 Statistical Analysis of the BIBD 4.4.2 Least Squares Estimation of the Parameters	**CH. 4 (4.4.1 , 4.4.2)**

W	List of Topics	Text book
10 & 11	**Introduction to Factorial Designs.** **5.3 Two factor Factorial Designs.** 5.3.1 An Example 5.3.2 Statistical Analysis of the Fixed Effects Model 5.3.3 Model Adequacy Checking 5.3.4 Estimating the Model Parameters 5.3.7 One Observation per Cell	**CH. 5 (5.3.1-5.3.4, 5.3.7)**
12	**The General Factorial Design.**	**CH. 5 (5.4)**
13	**2nd midterm exam**	
14 15	**The 2^kFactorial Design** 6.1 Introduction 6.2 The 2^2 Factorial Design 6.3 The 2^3 Factorial Design	**CH.6(6.1-6.3)**
16	**Regression and Analysis of Covariance**	

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Exam 1	7^{th}	20
2.	Exam 2	13^{th}	20
3.	Project	14^{th}	10
4.	Home Works	1^{st}-14^{th}	10
5.	Final Exam	15^{th}	40

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

Essential References	Design and Analysis of Experiments 10th edition. Wiley and Sons D. C. Montgomery, 2017
Supportive References	
Electronic Materials	
Other Learning Materials	