

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): STAT 2810 DESIGN AND ANALYSIS OF EXPERIMENTS (3,3,0)

Course Aims: To provide an understanding of various kinds of experimental designs involving factorial and uniform designs as well as design for computer experiments. The experimental design has a long history and has been widely used in industry, agriculture, quality control, natural sciences and computer experiments. They can be applied to survey design as well. Therefore, they are useful in business and social sciences. The statistical package, SAS and UD4.0 will be used to support the lecture.

Prerequisite: STAT 2110 Regression Analysis

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Learning Outcomes (LOs)

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand the basic experimental designs
2	Able to understand the mathematical theory of experimental designs
3	Able to apply the theory for experimental design in real life
	Skills
4	Able to use regression method and ANOVA to find optimal experimental points
5	Able to use Uniform design table to find an optimal regression design
6	Able to design and implement factorial design
	Attitude
7	Able to solve problems independently

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment (assignments, Mid-term test)	40%	Assignments are designed to measure students understanding of the theory of experimental designs, the test is designed to see how far students have achieved their intended learning outcomes and to see what they need to improve.
2	Final Examination	60%	Final Examination is designed to see how far students have achieved their intended learning outcomes especially in the Knowledge domain. Students should have a thorough understanding of the knowledge and apply them correctly in different context to do well in the exam.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Introduction	1	2
II. Experiments with a Single Factor	1, 2, 4, 7	6
III. Factorial Designs	2, 3, 4, 6, 7	9
IV. Optimal Designs	2, 4, 6, 7	5
V. Design of Computer Experiments	2, 3, 5, 6, 7	15
V. Experiments with Mixtures	2, 3, 5, 6, 7	5

Textbook: 方開泰、馬長興，正交與均勻試驗設計，科學出版社，2001。

D.C. Montgomery, Design and Analysis - Analysis of Experiments, 5th Ed., Wiley, 2001.

References: H. Toutenbury, Experimental Design and Model Choice, Physica-Verlag, 1995.

J.A. Cornell, Experiments with Mixtures, 2nd Ed., Wiley, 1990.

M.Hamada and Jeff C.F. Wu, Experiments: Planning, Analysis, and Parameter Design Optimization, Wiley, 2000.

Course Content in Outline:

Topic	Hours
I. Introduction	2
A. What is experimental design?	
B. Applications of experimental design	
C. Basic concepts	
D. Brief introduction to various designs	
II. Experiments with a Single Factor	6
A. Two kinds of errors	
B. Analysis of variance	
C. Fixed effects and random effects	
D. Multiple comparison tests	
III. Factorial Designs	9
A. Two-factor factorial designs	
B. Orthogonal designs	
C. Orthogonal designs with interactions	
D. Construction of orthogonal designs	
E. Aberration, regular and non regular designs	
F. Factorial designs with model unknown: Uniform designs	
IV. Optimal Designs	5
A. Models	
B. Optimality measures	
C. Kinds of optimal designs	
V. Design of Computer Experiments	15
A. Design in system engineering	
B. Latin hypercube designs and its versions	
C. Uniform designs	
D. Modeling techniques	
E. Uniformity measures	
F. Generation of uniform design tables	
G. Applications of uniformity to factorial designs	
VI. Experiments with Mixtures	5
A. The problems with mixtures	
B. Simplex-lattice designs	
C. Simplex-centroid axial designs	
D. Uniform designs with mixtures	
E. Uniform designs with mixture restrictions	