UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: May 1994
REVISED COURSE IMPLEMENTATION DATE: September 2021
COURSE TO BE REVIEWED (six years after UEC approval)**:** November 2025
Course outline form version: 05/18/2018

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: STAT 330

Number of Credits: 3 Course credit policy (105)

Course Full Title: Design of Experiments
Course Short Title:
(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)

Faculty: Faculty of Science

Department (or program if no department): Mathematics & Statistics

Calendar Description:

Designing experiments, including factorial, 2^k, fractional and blocked experiments, confounding, fixed effects, random effects, mixed effects models, variance components. Statistical software is used for data analysis. Students design their own experiments and write a report on the resulting collection and analysis of data.

Prerequisites (or NONE):	One of the following: STAT 104 with a B+ or better, STAT 106 with a B or better, STAT 270, or STAT 271.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Antirequisite Courses *(Cannot be taken for additional credit.)*
Former course code/number: **MATH 330**
Cross-listed with:
Dual-listed with:
Equivalent course(s):
(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar hours	40
Tutorials/workshops	
Supervised laboratory hours	10
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**50**

Labs to be scheduled independent of lecture hours: ☒ No ☐ Yes

Special Topics *(Double-click on boxes to select.)*
This course is offered with different topics:
☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

Independent Study
If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*
☒ No ☐ Yes, repeat(s) ☐ Yes, no limit

Transfer Credit
Transfer credit already exists: *(See* ***bctransferguide.ca****.)*
☐ No ☒ Yes

Submit outline for (re)articulation:
☒ No ☐ Yes *(If yes, fill in transfer credit form.)*

Grading System
☒ Letter Grades ☐ Credit/No Credit

Maximum enrolment (for information only): 36

Expected Frequency of Course Offerings:
Every 2nd year *(Every semester, Fall only, annually, etc.)*

Department / Program Head or Director: Ian Affleck	**Date approved:**	June 15, 2020
Faculty Council approval	**Date approved:**	September 11, 2020
Dean/Associate VP: Lucy Lee	**Date approved:**	September 11, 2020
Campus-Wide Consultation (CWC)	**Date of posting:**	n/a
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	January 29, 2021

Learning Outcomes:

Upon successful completion of this course, students will be able to:

1. Use one-factor, two-factor and higher order factorial designs.
2. Explain the reasoning and importance of the basic experimental practices of randomization, blocking, confounding, and replication.
3. Use fixed effects, random effects, and mixed effects models and demonstrate the differences.
4. Use designs with blocking factors.
5. Use 2^k designs, including blocked and fractional 2^k designs.
6. Identify the alias structure and resolution of fractional 2^k designs.
7. Use a statistical software package to analyze data from all experiments.
8. Design an experiment, collect the data, analyze the data, and write a report, including recommendations for future research.
9. Integrate feedback and suggestions from faculty and supervisors in completion and presentation of report findings.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

Lectures, computer work, discussion both in and out of class, group work for project.

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

The textbook is chosen by a departmental curriculum committee. Recent texts used:

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Montgomery, D.C.	*Design and Analysis of Experiments, 9th ed.*	☐	Wiley	2017
References					
2	Box, G.E.P., Hunter, W.G. and Hunter, J.S.	*Statistics for Experimenters. 2nd ed.*	☐	Wiley	2005
3.	Fleiss, Joseph L.	*The Design and Analysis of Clinical Experiments*	☐	Wiley	1999
4.	Crowder, M.J. and Hand.	*Analysis of Repeated Measures*	☐	Chapman and Hall	1990
5.	Cox, D.R.	*The Design of Experiments*	☐	Wiley	1957

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Typical Evaluation Methods and Weighting

Final exam:	45%	Assignments:	10%	Field experience:	%	Portfolio:	%
Midterm exam:	15%	Project:	10%	Practicum:	%	Other:	5%
Quizzes/tests:	15%	Lab work:	%	Shop work:	%	Total:	100%

Details (if necessary):
The above percentages may vary among instructors and years. The final exam is comprehensive. Students must obtain at least 40% on the final exam in order to receive credit for this course.

Typical Course Content and Topics

- Linearity: the assumptions of a linear model, linear effects and a linear error term. Randomisation.
- Experiments with one factor, fixed effects, random effects, estimation of model parameters, ANOVA, multiple comparisons.
- Blocked designs: matched pairs, randomised complete blocks, Latin squares, multiple Latin squares, Graeco-Latin squares, balanced incomplete blocks.
- Factorial designs: 2^k designs. Yates' plussing and minussing, Daniels' method of plotting to select contrasts of interest in saturated designs.
- Blocking in 2^k designs, fractional factorial designs, confounding and aliasing. Selecting a fractional factorial design, implications of the selection, replication. Designs of Resolution R.
- Variance components: variance component models in balanced designs, construction of appropriate models, interpretation of tests, confidence intervals for fixed effects.
- If time allows: Response surface methods: use and estimation of local quadratic approximations, the search for an optimum.
- Cross-over designs: conditions under which they are appropriate, analysis and interpretation.
- Split-plot designs: common repeated measure designs and corresponding uni-variate models and analysis.