UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: May 1994
REVISED COURSE IMPLEMENTATION DATE: September 2020
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 18 2019
Faculty Council approval	**Date approved:**	October 4, 2019
Dean/Associate VP:	**Date approved:**	October 4, 2019
Campus-Wide Consultation (CWC)	**Date of posting:**	November 8, 2019
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	November 22, 2019

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

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.