



The University of Southern Queensland

Course specification

This version produced 7 Jul 2008.

The current and official versions of the course specifications are available on the web at
<<http://www.usq.edu.au/coursespecification/current>>.

Please consult the web for updates that may occur during the year.

Description: Experimental Design

| Subject | Cat-nbr | Class | Term | Mode | Units | Campus |
|---------|---------|-------|---------|------|-------|-----------|
| STA | 3300 | 62251 | 1, 2007 | EXT | 1.00 | Toowoomba |

| | |
|-----------------------------------|--------|
| Academic group: | FOSCI |
| Academic org: | FOS003 |
| Student contribution band: | 2 |
| ASCED code: | 010103 |

STAFFING

Moderator: Ashley Plank

REQUISITES

Pre-requisite: STA2300 or USQIT16

RATIONALE

The proper design, implementation and analysis of results of experiments are of vital importance in many disciplines. The validity and reliability of research findings can be severely compromised if a poor design or experimental procedure is followed. This course introduces principles of good design in experiments and discusses appropriate methods of analysis of planned experiments. This course has relevance to all students planning or planning to be involved in experimental projects, especially students in the general science disciplines. Previous statistical knowledge to the level of STA2300 Data Analysis only is assumed.

SYNOPSIS

This course covers principles of design such as randomisation, replication, factorial arrangement and blocking. Practical experience is gained in designing, carrying out, analysing and writing up the results of an experimental study. Methods of analysis are discussed and practiced, mainly on computer. The emphasis is on general principles of design and analysis rather than in describing the details of particular design layouts. Consideration is given to assumption checking, robustness, prior and posterior analysis, contrasts, confounding, covariates, error control and reduction, and interpretation of results.

OBJECTIVES

On completion of this course students will be able to:

1. recognise the need for and implement procedures for randomisation (Assignment 1 and 2, Project);
2. recognise the importance of factorial arrangements and replication (Assignment 2, Project);
3. recognise the advantages and disadvantages of blocking (Assignment 2, Project);

4. analyse a data set in an appropriate fashion using a computer package (Assignment 1 and 2, Project);
5. interpret the results of an analysis in everyday terms (Assignment 1 and 2, Project).

TOPICS

| | Description | Weighting (%) |
|----|--|---------------|
| 1. | Data Screening - introduction to a computer package - exploratory and preliminary analysis - descriptive and graphical tools - transformations | 10.00 |
| 2. | Inference - hypothesis testing and p values - estimation and confidence intervals - comparative experiments, independent and dependent samples - linear regression, dummy variables | 10.00 |
| 3. | Introduction to experimentation - observational v experimental studies - causality and correlation - validity - some design principles | 10.00 |
| 4. | Completely randomised designs with one factor - experimental procedure - principle of randomisation - modelling the data - analysis of variance and interpretation - descriptive techniques - residual analysis - nonparametric techniques | 15.00 |
| 5. | Analytic comparisons - contrasts, simple and complex, - planned and unplanned comparisons - multiple comparisons and error rates - Newman-Keuls range tests | 15.00 |
| 6. | Balanced factorial experiments - principles of factorial arrangement - descriptive techniques - main and interaction effects - multiway analysis of variance - estimation of effects - model fitting | 15.00 |
| 7. | Blocking - principle of error reduction - single and multifactor arrangements - random and fixed effects - calculation of expected mean squares - components of variance | 15.00 |
| 8. | Regression Analysis - analysis and interpretation - analysis of covariance - trend analysis | 10.00 |

TEXT and MATERIALS required to be PURCHASED or ACCESSED

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at <http://bookshop.usq.edu.au> click 'Semester', then enter your 'Course Code' (no spaces).

SPSS Windows Software, Prentice Hall,

(Student Version 14.0 for Windows (Version 10.0 or later is acceptable) available through USQ Bookshop)

REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Box, G E P, Hunter, W G & Hunter, J S 1978, *Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building*, Wiley, New York.

(001.424 Box)

Coakes, S J & Steed, L G 2005, *SPSS: Analysis without Anguish*, Jacaranda Wiley,

(Version 13.0 for Windows 005.369 Coa)

Hicks, C R 1999, *Fundamental Concepts in the Design of Experiments*, 5th edn, Oxford University Press, New York.

(001.434 Hic)

Mason, R L, Gunst, R F & Hess, J L 2003, *Statistical Design and Analysis of Experiments with Applications to Engineering and Science*, 2nd edn, Wiley, New York.

(519.5 Mas)

Maxwell, S E & Delaney, H D 2003, *Designing Experiments and Analysing Data: A Model Comparison Perspective*, 2nd edn, Wadsworth, Belmont.

(519.53 Max)

STUDENT WORKLOAD REQUIREMENTS

| ACTIVITY | HOURS |
|---------------|--------|
| Assessment | 20.00 |
| Examinations | 3.00 |
| Private Study | 146.00 |

ASSESSMENT DETAILS

| Description | Marks out of | Wtg(%) | Due date |
|------------------------|--------------|--------|------------------------|
| ASSIGNMENT 1 | 100.00 | 10.00 | 04 May 2007 |
| ASSIGNMENT 2 | 100.00 | 10.00 | 25 May 2007 |
| PROJECT PROPOSAL | 0.00 | 0.00 | 01 Jun 2007 |
| PROJECT | 100.00 | 30.00 | 29 Jun 2007 |
| EXAM 2 HOUR RESTRICTED | 100.00 | 50.00 | END S1 (see note 1) |

NOTES

1. Examination dates will be available during the Semester. Please refer to Examination timetable when published.

IMPORTANT ASSESSMENT INFORMATION

- 1 Attendance requirements:

There are no attendance requirements for this course. However, it is the students' responsibility to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

- 2 Requirements for students to complete each assessment item satisfactorily:
To complete an assessment item satisfactorily, students must obtain at least 50% of the marks available for that assessment item. Students do not have to satisfactorily complete each assessment item to be awarded a passing grade in this course. Refer to Statement 4 below for the requirements to receive a passing grade in the course.
- 3 Penalties for late submission of required work:
If students submit assignments after the due date without prior approval then a penalty of 10% of the total marks gained by the student for the assignment will apply for each working day late.
- 4 Requirements for student to be awarded a passing grade in the course:
To be assured of receiving a passing grade a student must achieve at least 30% in all of the weighted assessment items, achieve at least 40% in the examination and at least 50% of the total weighted marks available for the course.
- 5 Method used to combine assessment results to attain final grade:
The final grades for students will be assigned on the basis of the weighted aggregate of the marks obtained for each of the summative assessment items in the course.
- 6 Examination information:
In a Restricted Examination, candidates are allowed access to specific materials during the examination. The only materials that candidates may use in the restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); calculators which cannot hold textual information (students must indicate on their examination paper the make and model of any calculator(s) they use during the examination. With the Examiner's approval, candidates may take an appropriate non- electronic translation dictionary into the examination. This will be subject to perusal and, if it is found to contain annotations or markings that could give the candidate an unfair advantage, it may be removed from the candidate's possession until the appropriate disciplinary action is completed.
- 7 Examination period when Deferred/Supplementary examinations will be held:
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.
- 8 University Regulations:
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL <http://www.usq.edu.au/corporateservices/calendar/part5.htm> or in the current USQ Handbook.

ASSESSMENT NOTES

- 9 Students must retain a copy of each item submitted for assessment. This must be despatched to USQ within 24 hours of receipt of a request to do so from the Examiner.