Module Specification

Statistical Research Methods

Version: 2021-22, v2.0, 30 Sep 2021

Contents

Part 1: Information

Module title: Statistical Research Methods

Module code: UFMFK7-30-3

Level: Level 6

For implementation from: 2021-22

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: Frenchay Campus

Field: Engineering, Design and Mathematics

Module type: Standard

Pre-requisites: Statistical Modelling 2021-22

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module is concerned with the careful use of quantitative research methodology and the application of statistical techniques in empirical research.

Features: Not applicable

Educational aims: See Learning Outcomes.

Outline syllabus: The syllabus includes:

Advanced modelling techniques:
Binary, ordinal and nominal logistic regression models: application, theoretical underpinning, model diagnostics.
Discriminant Analysis: applications and interpretation, theoretical underpinning, model diagnostics.
Multivariate Analysis of Variance.
Survival Analysis.

Biomedical research techniques:
Principles of experimental designs relating to medical studies including the clinical control randomised trial (randomisation, replication, blinding, use of controls, trial protocol, and the conduct of CRT); prospective cohort studies, case control studies, cross-sectional studies, longitudinal studies, cross-over trials, and their conduct.
Determination of sample size for a given study.
The analysis of category data arising in a medical context including (odds ratios within and across strata, relative risk, log-linear modelling, sensitivity, specificity, negative predictive value, positive predictive value, evaluating predictive value of a test using Bayes Theorem, ROC curves).
Measures of reliability including Intra Class Correlations, Bland-Altman plots, Cohen's kappa.
Analysis of survival data including the proportional hazards survival model, estimation of survival probabilities, Kaplan-Meier survival curves, log rank tests.

Industrial Studies:
Two-level full and fractional factorial designs, central composite and rotatable designs and process optimisation.
Taguchi methods and their role in product design and quality improvement.

Time Series Analysis:
ARIMA modelling.

Missing data:

Concepts of missingness (MCAR, CAR, NMAR); effects of missing data; methods for handling missing data (e.g. imputation, multiple imputation, mean imputation, last one carried forward, listwise deletion, pairwise deletion); limitations and consequences of missing data.

Meta-analysis:
Introduction to meta-analysis. Systematic reviews, publication bias, effect sizes, random and fixed effects models; examples taken from the empirical literature.

Familwise error rate:
Multiple comparisons in ANOVA (e.g. Tukey's test, Student-Newman-Keuls test, Ryan-Einot-Gabriel-Welch tests, least significant difference), Tamhane's test, Games-Howell test, Hsu's test) and techniques to control Type I error rates (e.g. Bonferroni-Dunn, Hochberg step down, Hochberg step up) and the False Discovery Rate. When to use these tests.

Part 3: Teaching and learning methods

Teaching and learning methods: The module is delivered by means of lectures, tutorials/practicals or workshops. To prepare for assessment, students are expected to undertake self-directed learning in addition to the directed learning which supports taught classes:

Contact time: 75 hours
Assimilation and development of knowledge: 150 hours
Assessment: 75 hours
TOTAL: 300 HOURS

Scheduled teaching hours takes the form of two concurrent streams:

Stream 1:
Whole group lectures, used to deliver new material and to consolidate previous material.

Weekly computer practical, with activities following on directly from the lecture to develop analytical skills and gain practical experience.

Stream 2:
A fortnightly lecture/workshop session used to introduce major themes and use case studies, published research papers and research examples.
A fortnightly tutorial/practical session used to discuss the themes introduced in the lecture/workshop in Stream 2.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Appropriately apply advanced statistical techniques in empirical research using modern day software On successful completion of this module students will achieve the following learning outcomes.

MO2 Assess model diagnostics to inform empirical model building On successful completion of this module students will achieve the following learning outcomes.

MO3 Interpret and explain a wide variety of empirical statistical models in different context (own analyses or research papers) On successful completion of this module students will achieve the following learning outcomes.

MO4 Examine limitations of inference from statistical models based on model evaluation techniques and the way the data have been generated On successful completion of this module students will achieve the following learning outcomes.

MO5 Show detailed knowledge of the role played by statistical design in medicine and industry On successful completion of this module students will achieve the following learning outcomes.

MO6 Conduct literature searches to support empirical investigations and to correctly cite sources of information

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 225 hours

Face-to-face learning = 75 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/ufmfk7-30-3.html

Part 4: Assessment

Assessment strategy: Component A consists of three assessments which assesses students' understanding of concepts and techniques as well as their ability to interpret results within different contexts.

The first assessment requires an analysis of a large consultancy data set and to be an information forager in the statistical sciences

The second assessment requires the student to act as a research methodologist contributing to a research grant development and applying advanced statistical techniques

The third assessment is investigative time series on a societal problem, statistical analysis on advanced techniques and the critical assessment of journal articles

The resit assessment will use the same portfolio of activities. The resit assessment is fully commensurate with first attempt assessment

Assessment components:

Written Assignment - Component A (First Sit)
Description: Coursework 3
Weighting: 40 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6

Written Assignment - Component A (First Sit)

Description: Coursework 1

Weighting: 30 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4, MO6

Written Assignment - Component A (First Sit)

Description: Coursework 2

Weighting: 30 %

Final assessment: No

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6

Written Assignment - Component A (Resit)

Description: Coursework portfolio equivalent to components in the first opportunity

Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested:

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mathematics and Statistics [Sep][FT][Frenchay][3yrs] BSc (Hons) 2019-20

Mathematics and Statistics [Sep][SW][Frenchay][4yrs] BSc (Hons) 2018-19

Mathematics and Statistics {Foundation} [Sep][FT][Frenchay][4yrs] BSc (Hons) 2018-19

Mathematics [Sep][FT][Frenchay][3yrs] BSc (Hons) 2019-20

Mathematics [Sep][SW][Frenchay][5yrs] MMath 2018-19

Mathematics [Sep][SW][Frenchay][4yrs] BSc (Hons) 2018-19

Mathematics {Foundation} [Sep][FT][Frenchay][4yrs] BSc (Hons) 2018-19