MODULE SPECIFICATION

Part 1: Information			
Module Title	Statistical Modelling		
Module Code	UFMFNA-30-2	Level	Level 5
For implementation from	2019-20		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Faculty of Environment & Technology	Field	Engineering, Design and Mathematics
Department	FET Dept of Engin Design & Mathematics		
Module type:	Standard		
Pre-requisites	Statistical Reasoning 2019-20		
Excluded Combinations	None		
Co- requisites	None		
Module Entry 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.

Educational Aims: See Learning Outcomes.

Outline Syllabus: The syllabus includes:

Understanding Research:
Induction, deduction and the scientific method. Aspects of scientific and statistical inference.

Basic Principles of Estimation and Inference:
Theory underpinning non-parametric tests and applications to factors with two and more than two levels including the Mann Whitney test, Wilcoxon test, Kruskal-Wallis Test, Friedman's test, Iman Davenport test, modified Friedman's test and appropriate corrected post hoc analyses. Robust tests of dispersion (e.g. Levene's test) and tests of non-parametric correlation (e.g. Spearman's rank correlation, Kendall's tau). The rationale of non-parametric test and an overview of lesser known tests such as Kolmogorov-Smirnov test, Wald Wolfowitz test, Moses' test, Median test, Sign test, McNemar test, Kendall's W, Cochran's Q, Mann Kendall test, Runs test.

Design of Experiments and Analysis of Experimental Data:

The need for experimental designs. Random selection, randomisation and blocking. Complete factorial designs. The need for replication. One-way analysis of variance. One-way blocked designs (one-way repeated measures designs). Two-way and three-way between-subjects factorial designs. Two-way designs for repeated measures data and two-way mixed designs. Theoretical rationale for the use of the F-distribution in experimental designs. An introduction to multiple comparison tests and their development and theory. Limitations of inference from observational designs. Power of the test.

Simple Linear Regression:
Linear regression - revision of basic ideas, calculation of residuals and use of residuals as diagnostics for assessing model adequacy. Model interpretation. Model diagnostics such as leverage, Cook's distance, standardised residuals, Studentized residuals, deleted residuals and delta-beta measures of influence. Hypothesis testing for model parameters. Assessment of homoscedasticity (e.g. Goldfeld-Quandt test, Glejser test); independence and normality of residuals.

Multiple regression:
Including the above on linear regression along with model formulation, the use and problems associated with automated selection techniques including backward elimination, forward selection and stepwise methods. Model interpretation and assessing adequacy of model. The use of dummy variables (referential coding) and interactions. Limitations of model inference, e.g. problems arising from near multicollinearity. Theoretical rationale for the use of the t-distribution and the F-distribution under the linear regression model. Partial correlations and their interpretation.

Modern Computational Approaches:
An introduction to computer intensive tests including Monte-Carlo methods, randomisation tests, and bootstrap tests of significance and parameter estimation, and simulation derivation of sampling distributions.

Introduction to forecasting:
Approaches to forecasting. The role of forecasting in planning and decision making. Problems of applying statistical forecasting methods e.g. data collection, definition of variable to be forecast, etc. Decomposition methods for time series forecasting. Measuring the trend, seasonal, cyclical and random components of a time series. Preparing a forecast based on the decomposition method. Smoothing Methods - simple exponential smoothing. Adaptive methods, e.g. Chow and Trigg and Leach. Brown's single parameter, double exponential smoothing method. Holt's two parameter method. The Holt-Winter's method. Monitoring Methods. Tracking signals. Cusum charts.

Ethical considerations in Quantitative Research.

Applications of statistical techniques in sustainability research.

Process Control:
Six sigma including process monitoring using control charts for variables and attributes, cusum charts, operating characteristic and average run length.
Quality improvement.

Teaching and Learning Methods: See Assessment strategy.

Part 3: Assessment
Component A consists of a partly-seen examination which assesses students' understanding of concepts and techniques as well as their ability to interpret results within different contexts. Component B consists of four coursework assignments. Each coursework assignment requires students to prepare a report. The mark for Component B is determined from the best three out of four assignments.

First Sit Components	Final Assessment	Element weighting	Description
Written Assignment - Component B		50 %	B1. 2000 word written assignment 1 B2. 2000 word written assignment 2 B3. 2000 word written assignment 3 Equally weighted using best two marks from the three possible marks.
Examination - Component A	✓	50 %	Written examination (3 hours)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Written Assignment - Component B		50 %	3000-4000 word written assignment comparable with two assignments in the first assessment attempt
Examination - Component A	✓	50 %	Written examination (3 hours)

Part 4: Teaching and Learning Methods

Learning Outcomes

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

Module Learning Outcomes	Reference
Show a detailed knowledge and understanding of the quantitative research paradigm	MO1
Correctly chose and conduct statistical investigations and being able to make valid inferences and understand limitations	MO2
Use bespoke statistical software including Minitab, R, SPSS and Excel for statistical analyses	MO3
Analyse data collected over time	MO4
Write reports which will effectively communicate results of statistical investigations	MO5

Contact Hours

Independent Study Hours:	
Independent study/self-guided study	228
Total Independent Study Hours:	228
Scheduled Learning and Teaching Hours:	
Face-to-face learning	72
Total Scheduled Learning and Teaching Hours:	72
Hours to be allocated	300
Allocated Hours	300

Reading List	*The reading list for this module can be accessed via the following link:* https://uwe.rl.talis.com/modules/ufmfna-30-2.html

Part 5: Contributes Towards
This module contributes towards the following programmes of study: Mathematics and Statistics [Sep][SW][Frenchay][4yrs] BSc (Hons) 2018-19 Mathematics [Sep][SW][Frenchay][4yrs] BSc (Hons) 2018-19 Mathematics [Sep][SW][Frenchay][5yrs] MMath 2018-19 Mathematics with Qualified Teacher Status (QTS) [Sep][FT][Frenchay][3yrs] BSc (Hons) 2018-19 Statistics [Sep][FT][Frenchay][3yrs] BSc (Hons) 2018-19 Mathematics and Statistics [Sep][FT][Frenchay][3yrs] BSc (Hons) 2018-19 Mathematics [Sep][FT][Frenchay][4yrs] MMath 2018-19 Mathematics [Sep][FT][Frenchay][3yrs] BSc (Hons) 2018-19