1. **Title of the module**

MAST5001 (MA5501) - Applied Statistical Modelling

MAST6008 (MA6508) - Applied Statistical Modelling

1. **School or partner institution which will be responsible for management of the module**

School of Mathematics, Statistics and Actuarial Science

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 5 (MAST5001), Level 6 (MAST6008)

1. **The number of credits and the ECTS value which the module represents**

15 credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Spring

1. **Prerequisite and co-requisite modules**

Level 5 module:

Pre-requisite: MAST4009 (Probability); MAST4011 (Statistics); MAST4004 (Linear Algebra) or MAST4005 (Linear Mathematics); MAST4006 (Mathematical Methods 1); MAST4007 (Mathematical Methods 2) or equivalent knowledge.

Co-requisite: None

Level 6 module:

Prerequisite: material equivalent to that covered above.

Co-requisite: None

1. **The course(s) of study to which the module contributes**

**Level 5:**

BSc Mathematics, BSc Mathematics and Statistics, BSc Financial Mathematics, BA Mathematics and Accounting and Finance, BSc Actuarial Science, MMath Mathematics, BSc Data Science, (including courses with a Year in Industry), BSc Mathematics with Secondary Education, BSc Mathematics with a Foundation Year, BSc Actuarial Science with a Foundation year, BSc Data Science with a Foundation Year, MMathStat Mathematics and Statistics

**Level 6:**

International MSc in Statistical Data Science, International MSc in Statistics with Finance (including courses with an Industrial Placement)

1. **The intended subject specific learning outcomes.  
   On successfully completing the level 5 module students will be able to:**

8.1 demonstrate knowledge and critical understanding of the well-established principles within statistical modelling using regression models and likelihood estimation;

8.2 demonstrate the capability to use a range of established techniques and a reasonable level of skill in calculation and manipulation to solve problems in the following areas: simple linear regression, linear models including estimation and diagnostics, one-way analysis of variance, maximum likelihood estimation, model selection strategies, estimation for the multivariate normal, partial and multiple correlation;

8.3 apply the concepts and principles in statistical modelling using regression models and likelihood estimation in well-defined contexts beyond those in which they were first studied, showing the ability to evaluate critically the appropriateness of different tools and techniques;

8.4 make appropriate use of R.

**On successfully completing the level 6 module students will be able to:**

8.5 demonstrate systematic understanding of key aspects of statistical modelling using linear regression models, likelihood estimation and logistic regression;

8.6 demonstrate the capability to deploy established approaches accurately to analyse and solve problems using a reasonable level of skill in calculation and manipulation in the following areas: simple linear regression, linear models including estimation and diagnostics, one-way analysis of variance, maximum likelihood estimation, model selection strategies, estimation for the multivariate normal, partial and multiple correlation, logistic regression;

8.7 apply key aspects of statistical modelling using regression models and likelihood estimation in well-defined contexts, showing judgement in the selection and application of tools and techniques;

8.8 show judgement in the application of R.

1. **The intended generic learning outcomes.  
   On successfully completing the level 5 module students will be able to:**

Demonstrate an increased ability to:

9.1 manage their own learning and make use of appropriate resources;

9.2 understand logical arguments, identifying the assumptions made and the conclusions drawn;

9.3 communicate straightforward arguments and conclusions reasonably accurately and clearly;

9.4 manage their time and use their organisational skills to plan and implement efficient and effective modes of working;

9.5 solve problems relating to qualitative and quantitative information;

9.6 make use of R, online resources (Moodle), internet communication;

9.7 communicate technical and non-technical material competently.

9.8 demonstrate an increased level of skill in numeracy and computation.

**On successfully completing the level 6 module students will be able to:**

9.9 manage their own learning and make use of appropriate resources;

9.10 understand logical arguments, identifying the assumptions made and the conclusions drawn;

9.11 communicate straightforward arguments and conclusions reasonably accurately and clearly;

9.12 manage their time and use their organisational skills to plan and implement efficient and effective modes of working;

9.13 solve problems relating to qualitative and quantitative information;

9.14 make competent use of R, online resources (Moodle), internet communication;

9.15 communicate technical and non-technical material competently;

9.16 demonstrate an increased level of skill in numeracy and computation;

9.17 demonstrate the acquisition of the study skills needed for continuing professional development.

1. **A synopsis of the curriculum**

Constructing suitable models for data is a key part of statistics. For example, we might want to model the yield of a chemical process in terms of the temperature and pressure of the process. Even if the temperature and pressure are fixed, there will be variation in the yield which motivates the use of a statistical model which includes a random component. In this module, students study linear regression models (including estimation from data and drawing of conclusions), the use of likelihood to estimate models and its application in simple stochastic models. Both theoretical and practical aspects are covered, including the use of R.

Indicative content: Simple linear regression; the method of least squares; sums of squares; the ANOVA table; residuals and diagnostics; matrix formulation of the general linear model; prediction; variable selection; one-way analysis of variance; practical regression analysis using software; multivariate normal distribution; logistic regression (level 6 only).

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**

Chatterjee, S., and Hadi, A.S. (2012) Regression analysis by example. 5th edition. Hoboken Wiley.

Draper, N. R., and Smith, H. (1998) Applied regression analysis. 3rd edition. Wiley.

Freedman, D. (2005) Statistical models: theory and practice. Cambridge University Press.

1. **Learning and teaching methods**

Total contact hours: 40

Private study hours: 110

Total study hours: 150

1. **Assessment methods**
   1. Main assessment methods

**Level 5**

Assessment 1 Exercises, requiring on average between 10 and 15 hours to complete 10%

Assessment 2 Exercises, requiring on average between 10 and 15 hours to complete 10%

Examination 2 hours 80%

The coursework mark alone will not be sufficient to demonstrate the student’s level of achievement on the module.

**Level 6**

Assessment 1 Exercises, requiring on average between 10 and 15 hours to complete 10%

Assessment 2 Exercises, requiring on average between 10 and 15 hours to complete 10%

Examination 2 hours 80%

The coursework mark alone will not be sufficient to demonstrate the student’s level of achievement on the module.

13.2 Reassessment methods

Like-for-like

1. **Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Level 5 Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 9.1 | 9.2 | 9.3 | 9.4 | 9.5 | 9.6 | 9.7 | 9.8 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |
| Private Study | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Lectures/Exercise classes | **X** | **X** | **X** | **X** |  | **X** | **X** |  | **X** |  | **X** | **X** |
| Terminal classes | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** | **X** | **X** |
| Revision classes | **X** | **X** | **X** |  |  | **X** | **X** |  | **X** |  | **X** | **X** |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |
| Examination | **X** | **X** | **X** |  | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** |
| Coursework | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Level 6 Module learning outcome** | 8.5 | 8.6 | 8.7 | 8.8 | 9.9 | 9.10 | 9.11 | 9.12 | 9.13 | 9.14 | 9.15 | 9.16 | 9.17 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Private Study | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Lectures/Exercise classes | **X** | **X** | **X** | **X** |  | **X** | **X** |  | **X** |  | **X** | **X** |  |
| Terminal classes | **X** | **X** | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** | **X** | **X** |  |
| Revision classes | **X** | **X** | **X** |  |  | **X** | **X** |  | **X** |  | **X** | **X** |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Examination | **X** | **X** | **X** |  | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** | **X** |
| Coursework | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |

1. **Inclusive module design**

The School recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Statistics as a branch of mathematics is an international language with techniques developed and refined by statisticians across the globe. Mastery of the subject-specific learning outcomes, 8.1 to 8.8, will equip students to apply the theories and techniques of this module in a wide range of international contexts. The module team is drawn from the School of Mathematics, Statistics and Actuarial Science, which includes many members of staff with international experience of teaching and research collaboration.

In compiling the reading list, consideration has been given to the range of texts that are available internationally and a selection of texts has been identified to complement the delivery of the material.

Examples with an international dimension are included in the module where appropriate.

The support SMSAS provides to its students is also internationally attuned given our international student body.

**DIVISIONAL OFFICE USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

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| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 17/11/2021 | Minor | AY 2022/23 | 1 |  |
|  |  |  |  |  |