1. **Title of the module**

MAST5380 (MA538) - Applied Bayesian 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 6

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)**

Autumn term

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

Prerequisite module: MAST5007 Mathematical Statistics

Co-requisite: None

1. **The programmes of study to which the module contributes**

BSc (Hons) Mathematics, BSc (Hons) Mathematics and Statistics (including programmes with a Year in Industry), BSc (Hons) Mathematics with a Foundation Year, MMath Mathematics

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

8.1 derive posterior distributions when analytically tractable;

8.2 derive posterior summaries, such as estimates, from the posterior distribution, including the predictive distribution;

8.3 construct Bayesian hierarchical models and implement them in a suitable software package;

8.4 critically evaluate software output using convergence diagnostics;

8.5 interpret and report the output for inferential purposes.

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

9.1 use a logical mathematical approach to solve problems;

9.2 work with relatively little guidance;

9.3 solve problems and communicate in writing more effectively.

1. **A synopsis of the curriculum**

The origins of Bayesian inference lie in Bayes' Theorem for density functions; the likelihood function and the prior distribution combine to provide a posterior distribution which reflects beliefs about an unknown parameter based on the data and prior beliefs. Statistical inference is determined solely by the posterior distribution. So, for example, an estimate of the parameter could be the mean value of the posterior distribution. This module will provide a full description of Bayesian analysis and cover popular models, such as the normal distribution. Initially, the flavour will be one of describing the Bayesian counterparts to well known classical procedures such as hypothesis testing and confidence intervals. Outline Syllabus includes: Bayes Theorem for density functions; Exchangeability; Choice of priors; Conjugate models; Predictive distribution; Bayes estimates; Sampling density functions; Gibbs samplers; OpenBUGS; Bayesian hierarchical models; Applications of hierarchical models; Bayesian model choice.

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

A. Gelman, J.B. Carlin, H.S. Stern, D.B. Dunson, A. Vehtari and D.B. Rubin (2014). Bayesian Data Analysis. 3rd Edition, Chapman & Hall/CRC Texts in Statistical Science

D. Gamerman and H.F. Lopes (2006). Markov Chain Monte Carlo: Stochastic Simulation for Bayesian Inference. 2nd Edition, Taylor and Francis.

1. **Learning and teaching methods**

Total contact hours: 36

Private study hours: 114

Total study hours: 150

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

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)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 9.1 | 9.2 | 9.3 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |
| Private Study | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Lectures/Exercise classes | **X** | **X** | **X** | **X** | **X** | **X** |  | **X** |
| **Assessment method** |  |  |  |  |  |  |  |  |
| Assessment 1 | **X** | **X** | **X** |  |  | **X** | **X** | **X** |
| Assessment 2 | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Examination | **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**

This module is based on mathematical principles. Mathematics and statistics are international languages with techniques developed and refined by mathematicians and statisticians across the globe. Mastery of the subject-specific learning outcomes, 8.1 to 8.5, 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.

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
|  |  |  |  |  |
|  |  |  |  |  |

Revised FSO Jan 2018