1. **Title of the module**

MAST4007 (MA349) - Mathematical Methods 2

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 4

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**

Pre-requisite: MAST4006 (Mathematical Methods 1)

Co-requisite: None

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

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

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

8.1 demonstrate knowledge of the underlying concepts and principles associated with basic mathematical methods for functions of multiple variables;

8.2 demonstrate the capability to make sound judgements in accordance with the basic theories and concepts in the following areas, whilst demonstrating a reasonable level of skill in calculation and manipulation of the material: vectors, partial differentiation, stationary points of functions, double integration;

8.3 apply the underlying concepts and principles associated with basic multiple-variable techniques in several well-defined contexts, showing an ability to evaluate the appropriateness of different approaches to solving problems in this area;

8.4 make appropriate use of Maple.

1. **The intended generic learning outcomes.  
   On successfully completing the 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 information technology skills such as online resources (Moodle) and Maple;

9.7 communicate technical and non-technical material competently.

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

1. **A synopsis of the curriculum**

This module introduces widely-used mathematical methods for vectors and functions of two or more variables. The emphasis is on the practical use of these methods; key theorems are stated but not proved at this stage. Tutorials and Maple worksheets will be used to support taught material.

Vectors: Cartesian coordinates; vector algebra; scalar, vector and triple products (and geometric interpretation); straight lines and planes expressed as vector equations; parametrized curves; differentiation of vector-valued functions of a scalar variable; tangent vectors; vector fields (with everyday examples)

Partial differentiation: Functions of two variables; partial differentiation (including the chain rule and change of variables); maxima, minima and saddle points; Lagrange multipliers

Integration in two dimensions: Double integrals in Cartesian coordinates; plane polar coordinates; change of variables for double integrals; line integrals; Green’s theorem (statement – justification on rectangular domains only)

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

E. Kreyszig, Advanced Engineering Mathematics (10th edition), John Wiley, 2011

1. **Learning and teaching methods**

Total contact hours: 54

Private study hours: 96

Total study hours: 150

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

Assessment 1 Exercises, requiring on average between 10 and 15 hours to complete 20%

Assessment 2 Exercises, requiring on average between 10 and 15 hours to complete 20%

Examination 2 hours 60%

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 | 9.1 | 9.2 | 9.3 | 9.4 | 9.5 | 9.6 | 9.7 | 9.8 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |
| Private Study and Assessment | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Lectures/exercise classes | **x** | **x** | **x** |  | **x** | **x** | **x** |  | **x** |  | **x** |  |
| Terminal classes |  |  |  | **x** |  |  |  |  |  | **x** |  | **x** |
| Tutorials | **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** |

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**

Mathematics is an international language with techniques developed and refined by mathematicians across the globe. Mastery of the subject-specific learning outcomes, 8.1 to 8.4, 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.

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

**FACULTIES SUPPORT 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.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| July 2023 | MAJOR | Spring 2023 | 13 |  |
|  |  |  |  |  |