1. **Title of the module**

MAST6017 (MA6517) - Functions of a complex variable

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

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

Pre-requisite: MAST4010 (Real Analysis 1) and MAST5013 (Real Analysis 2)

Co-requisite: None

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

BSc Mathematics, BSc Mathematics and Statistics (including programmes with a Year in Industry), BSc Mathematics with a Foundation Year, MMath Mathematics, MMathStat Mathematics and Statistics, Graduate Diploma in Mathematics, International MSc in Mathematics and its Applications, MSc Mathematics and its Applications (including programme with an Industrial Placement)

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

8.1 demonstrate systematic understanding of key aspects of complex analysis;

8.2 demonstrate the capability to deploy established approaches accurately to analyse and solve problems using a reasonable level of skill in calculation and manipulation of the material in the following areas: power series, analytic functions, contour integrals, singularities, residues, Taylor and Laurent series, the residue theorem;

8.3 apply key aspects of complex analysis in well-defined contexts, showing judgement in the selection and application of tools and techniques.

1. **The intended generic learning outcomes.  
   On successfully completing the module students will be able 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 competent use of information technology skills such as online resources (Moodle), internet communication;

9.7 communicate technical material competently;

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

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

1. **A synopsis of the curriculum**

Revision of complex numbers, the complex plane, de Moivre's and Euler's theorems, roots of unity, triangle inequality

Sequences and limits: Convergence of a sequence in the complex plane. Absolute convergence of complex series. Criteria for convergence. Power series, radius of convergence

Complex functions: Domains, continuity, complex differentiation. Differentiation of power series. Complex exponential and logarithm, trigonometric, hyperbolic functions. Cauchy-Riemann equations

Complex Integration: Jordan curves, winding numbers. Cauchy's Theorem. Analytic functions. Liouville’s Theorem, Maximum Modulus Theorem

Singularities of functions: poles, classification of singularities. Residues. Laurent expansions. Applications of Cauchy's theorem. The residue theorem. Evaluation of real integrals.

Possible additional topics may include Rouche’s Theorem, other proofs of the Fundamental Theorem of Algebra, conformal mappings, Mobius mappings, elementary Riemann surfaces, and harmonic functions.

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

H.A. Priestley, Introduction to Complex Analysis, Oxford University Press, 2003

M.R. Spiegel, Complex Variables, McGraw-Hill, 1964

J.H. Mathews & R.W Howell, Complex Analysis for Mathematics and Engineering, Jones and Bartlett 5th ed., 2006

I Stewart & D Tall, Complex Analysis, Cambridge, 2004

1. **Learning and teaching methods**

Total contact hours: 42

Private study hours: 108

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 | 9.1 | 9.2 | 9.3 | 9.4 | 9.5 | 9.6 | 9.7 | 9.8 | 9.9 |
| **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** |  |
| 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** |

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 8.3, 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 | Minor | September 2023 | 6, 13 | No |
|  |  |  |  |  |