1. KentVision Code and title of the module

MAST5017 - Vector Calculus

## Division and School/Department or partner institution which will be responsible for management of the module

Division of Computing, Engineering and Mathematical Sciences (CEMS)

School of Mathematics, Statistics and Actuarial Science

## The level of the module (Level 4, Level 5, Level 6 or Level 7)

Level 5

## The number of credits and the ECTS value which the module represents

15 credits (7.5 ECTS)

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

Autumn or Spring

## Prerequisite and co-requisite modules and/or any module restrictions

Pre-requisite: MAST4014 (Calculus and Differential Equations)

## Co-requisite: None

## The course(s) of study to which the module contributes

Compulsory to the following courses: BSc Mathematics, BSc Mathematics and Statistics, MMath Mathematics (all including courses with a Year in Industry), BSc Mathematics with Secondary Education, BSc Mathematics with a Foundation Year.

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

## 8.1 demonstrate knowledge and critical understanding various concepts and quantities required in Newtonian mechanics and be aware of how these quantities are linked by equations, using vectors where appropriate;

8.2 demonstrate the capability to use a range of established techniques and a reasonable level of skill in calculation and manipulation in vector algebra, vector calculus, and change of variable methods for single and multivariable calculus;

8.3 relate an analytic problem involving several variables to its geometric context in two or more dimensions and be able to visualise aspects of the geometry of curves and surfaces.

## 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), internet communication;

9.7 communicate technical material competently.

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

## A synopsis of the curriculum

This module builds on MAST4014 Calculus and Differential Equations. The aim is to introduce the mathematical tools to perform calculations and apply these tools to interesting applications in physics. The syllabus is as follows:

Vectors: Introduction of vector algebra and products of vectors. Triple products of vectors. Vector geometry. Vector equations. Vector differentiation. Coordinate systems (Cartesian, plane polar, cylindrical polar and spherical polar coordinates).

Vector Calculus in 3D: Gradient, divergence, curl and the Laplacian. Applications and examples.

Integrals in 2D and 3D: Line integrals. Double and triple integrals. The Jacobian: geometrical interpretation and change of variables in multiple integrals. Green’s theorem in the plane. Stokes’ theorem and Divergence theorem (statement and simple examples). Applications in physics.

Classical Mathematical Modelling: Newton’s laws for a single particle, linear momentum, kinetic energy, work, potential energy, conservation of total energy. Angular velocity, angular momentum, moment of a force. Various applications and examples including central forces and simple harmonic motion.

## Reading list

The University is committed to ensuring that core reading materials are in accessible electronic format in line with the Kent Inclusive Practices.

The most up to date reading list for each module can be found on the university's [reading list pages](https://kent.rl.talis.com/index.html).

## Contact Hours

Contact hours: 42

Private study: 108

Total: 150

## 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

## Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section 12) and methods of assessment (section 13)

**Module learning outcomes against learning and teaching methods:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 |
| Private study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Lectures and example class activity | **x** | **x** | **x** |  | **x** | **x** |  | **x** |  | **x** | **x** |
| Revision classes | **x** | **x** | **x** |  | **x** | **x** |  | **x** |  | **x** | **x** |

**Module learning outcomes against assessment methods:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 |
| Examination | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |  | **x** | **x** |
| Coursework | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |

## Inclusive module design

The Division 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

## Campus(es) or centre(s) where module will be delivered

Canterbury

## 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.

**DIVISIONAL USE ONLY**

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

| Date approved | New/Major/minor revision | Start date of delivery of (revised) version | Section revised  (if applicable) | Impacts PLOs (Q6&7 cover sheet) |
| --- | --- | --- | --- | --- |
| 01/02/2023 | New | Spring 2025 | 8,11,12,14 | Yes |
|  |  |  |  |  |