Module Specification

Vector Calculus

Version: 2024-25, v3.0, 08 Jul 2024

Contents

Part 1: Information

Module title: Vector Calculus

Module code: UFMFRV-15-2

Level: Level 5

For implementation from: 2024-25

UWE credit rating: 15

ECTS credit rating: 7.5

College: College of Arts, Technology and Environment

School: CATE School of Computing and Creative Technologies

Partner institutions: None

Field: Computer Science and Creative Technologies

Module type: Module

Pre-requisites: Calculus and Numerical Techniques 2023-24

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This module extends the theory and methods of calculus beyond the single variable content seen in Year 1. The concept of a vector-valued function is introduced, together with the extension of derivatives to gradient, divergence and curl. Further, the theory and techniques of integration are developed to include double and triple integrals, and path and surface integrals of scalar and vector-valued functions. The important theorems of vector calculus (Green's Theorem in the Plane, Divergence Theorem and Stokes' Theorem) are presented. Throughout the

module, geometric interpretations are highlighted, and physical applications are presented both to aid understanding and illustrate the methods.

Features: Not applicable

Educational aims: The aims of the module are to provide further development of the students' calculus toolbox, with particular focus on applied problem solving using vector calculus methods. Students will appreciate the role that these methods play in fields including mechanics and fluid dynamics.

Outline syllabus: Vectors – review.
Scalar and vector fields. Different coordinate systems.
Derivatives of scalar functions - partial derivatives, gradient, directional derivatives, tangent planes.
Derivatives of vector fields - divergence, curl, physical interpretation.
Line integrals - path integrals for scalar and vector fields.
Double integrals - definition, methods, examples and applications (computing mass, centre of mass, etc. and average values), change of order of integration, change of variables, numerical methods.
Triple integrals – definition, methods, examples and applications.
Surfaces and surface integrals – surfaces, surface integrals for scalar and vector fields.
Integral theorems - Green's Theorem in the Plane, Divergence Theorem, Stokes' Theorem.

Part 3: Teaching and learning methods

Teaching and learning methods: The module is delivered by means of lectures and interactive tutorials. The tutorials will focus on problem-solving (worksheets) and provide a forum for discussion of any questions raised by students relating to their weekly learning. Standard teaching room with MATLAB and Python installed will be required for both lectures and tutorials. To prepare for assessment, students will be expected to undertake self-directed learning in addition to the directed learning which supports taught classes.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Use appropriate techniques to solve problems in vector analysis, including geometry, calculus and the integral theorems.

MO2 Understand the relationship between vector calculus quantities and computer-generated visualisations.

MO3 Apply vector calculus methods and mathematical reasoning to problems in physical applications.

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Total = 0

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/DD0F86F8-2527-F2CC-AE62-CFFF8433229A.html?lang=en-GB&login=1

Part 4: Assessment

Assessment strategy: The assessment strategy is designed to assess achievement of the learning outcomes.

The assessment consists of an end-of-module written online examination, which assesses work covered throughout the module. The exam will include unseen questions to assess students' ability to analyse and solve problems. The resit assessment will consist of a similar written examination.

Assessment tasks:

Examination (Online) (First Sit)
Description: Online examination (24 hour window)

Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO3

Examination (Online) (Resit)

Description: Online examination (24 hour window)

Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO3

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mathematics [Frenchay] BSc (Hons) 2023-24

Mathematics {Foundation} [Frenchay] BSc (Hons) 2022-23