Module Specification

Vector Calculus

Version: 2021-22, v1.0, 08 Sep 2020

Contents

Part 1: Information

Module title: Vector Calculus

Module code: UFMFRV-15-2

Level: Level 5

For implementation from: 2021-22

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Environment & Technology

Department: FET Dept of Engineering Design & Mathematics

Partner institutions: None

Delivery locations: Frenchay Campus

Field:

Module type: Standard

Pre-requisites: Calculus and Numerical Techniques 2020-21

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:

MO1 Apply and evaluate techniques to analyse and solve problems requiring calculus with vector-valued functions.

MO2 Distinguish between the integral theorems of vector calculus in terms of context, assumptions and applications.

MO3 Visualize geometric interpretations of concepts in vector calculus using appropriate software.

MO4 Communicate explanations, discussion, and evaluation of the use of vector calculus in physical applications.

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 114 hours

Face-to-face learning = 36 hours

Total = 150

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, to support the development of skills and to provide individual feedback such that students are aware of their progress during the module.

Component A consists of two elements.

A1 An end-of-module controlled-conditions written examination, which assesses work covered throughout the module.

The exam will include both partially-seen and unseen questions to assess students' ability to analyse and solve problems. The resit assessment will consist of a similar written examination.

A2 Two in-class tests, which build on formative assignments undertaken throughout the module.

In the resit assessment A2 will be replaced by a written assignment based on the formative problem-solving assignments undertaken throughout the module.

Assessment components:

Examination (Online) - Component A (First Sit)
Description: Online examination
Weighting: 75 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4

In-class test - Component A (First Sit)
Description: Best mark from 2 in-class tests (weeks 4 and 9 of the 12-week teaching block, each test lasting ~1 hour).
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO3, MO4

Examination (Online) - Component A (Resit)
Description: Online examination
Weighting: 75 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4

In-class test - Component A (Resit)
Description: A single written assignment, covering material assessed in in-class tests.
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mathematics [Sep][FT][Frenchay][3yrs] BSc (Hons) 2020-21

Mathematics [Sep][SW][Frenchay][4yrs] BSc (Hons) 2020-21