MODULE **DESCRIPTOR**

MODULE TITLE	VECTOR CALCULUS		
MODULE CODE	MA2832 (L5)	**CREDIT VALUE**	20 CREDITS (10 ECTS)
CAMPUS	UCLAN CYPRUS		
SCHOOL	SCHOOL OF SCIENCE		

MODULE **AIMS**

The aims of the module are to:

- Present to students a coherent development of vector calculus.
- Give students a range of techniques for solving problems using vector calculus.
- Give students' an understanding of the applications of vector calculus to physical problems.

MODULE **CONTENT**

Vectors and Scalars
Deriving properties of scalar and vector products, Triple products, Lines and planes in three-dimensional space, Parametric representations of curves and surfaces, Vector and scalar fields, Polar coordinate systems.

Vector Differentiation
Ordinary derivatives of vectors, Space curves, Vector differentiation formulae (product rules etc), Application to velocity and acceleration, Partial differentiation of vectors with two or three independent variables.

Vector Differential Operators
Gradient, Applications to directional derivatives and normal vectors to surfaces, Divergence and Curl, Applications to fluid flow, Deriving rules of vector differentiation.

Vector Integration
Integration of vector-valued functions, Line integrals of scalar and vector fields, Conservative fields and path independence, Surface integrals, Volume integrals, Exploiting alternative coordinate systems.

Vector Integration Theorems (with Proofs)
Green's theorem in the plane, Result in vector notation, Area enclosed by a curve, Divergence theorem, Stokes's theorem with extension to surfaces with multiple boundaries.

Curvilinear Coordinates
Definitions, Expressions for gradient, divergence and curl in general orthogonal curvilinear coordinates, Application to spherical and cylindrical polar coordinates.

Differential Geometry
Regular space curves, Arc length, Tangent unit vector, Principal normal and bi-normal unit vectors, Frenet-Serret formulae, Curvature and Torsion, Plane curves, General helices, Bertrand curves.

Applications of Vector Calculus
Applications such as fluid dynamics and electromagnetic theory will be mentioned as appropriate.

INTENDED **LEARNING OUTCOMES**

On successful completion of this module a student will be able to:	
1.	Demonstrate an understanding of the theory and techniques of vector calculus,
2.	Apply the techniques of vector calculus to a range of appropriate problems,
3.	Demonstrate understanding of the theory and properties of curvilinear coordinates,
4.	Apply vector calculus methods to appropriate physical situations.

TEACHING **METHODS**

Classes will consist of lectures and tutorials. Lectures will introduce the theory and provide illustrative examples of its application. Students will learn through a formative process of tackling regular non-assessed worksheets. These will be discussed in the tutorials.

ASSESSMENT **METHODS**

The module is assessed through 2 assignments and a written examination.