Module code	SM-2202			
Module Title	Multivariate Calculus			
Degree/Diploma	Bachelor of Science (Mathematics)			
Type of Module	Major Core			
Modular Credits	4	**Total student Workload**	10	hours/week
		Contact hours	4	hours/week
Prerequisite	SM-1202 Advanced Mathematical Methods for the Sciences			
Anti-requisite	None			

Aims

The module is designed to introduce students who are majoring in mathematics to various topics in the calculus of functions of two or more variables.

Learning Outcomes

On successful completion of this module, a student will be expected to be able to:

Lower order :	30%	- calculate the partial derivatives of functions of two or three variables; evaluate double and triple integrals in Cartesian, cylindrical and spherical coordinates; perform standard transformations of variables in multiple integrals; calculate the gradient of a scalar function and curl and divergence of a vector function
Middle order :	60%	- reverse the order of integration in a double integral; use integration to calculate areas, volumes and related quantities; use vector functions to formulate and evaluate line and surface integrals; apply potential theory to evaluate line integrals involving conservative vector fields; use Green's theorem in the plane to transform between line and area integrals
Higher order:	10%	- use partial differentiation to solve selected problems in error estimation and optimisation theory - work independently

Module Contents

- Partial Differentiation: Functions of two or more variables; partial derivatives and their geometric interpretation with applications to surfaces and equations of the tangent and normal planes; errors and their approximation; maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.

- Multiple Integrals: Double and triple integrals; change of the order of integration in double integrals; cylindrical and spherical coordinate systems; use of the Jacobian to transform the independent variables in a multiple integral; application of multiple integrals to evaluate surface areas and volumes, mass, centre of gravity and moment of inertia.

- Vector Calculus: Vector functions; gradient, divergence and curl; integration of vector point functions; line and surface integrals; conservative vector fields, independence of path and elementary potential theory; Green's theorem in the plane

Assessment	Formative assessment	Tutorial and feedback.
	Summative assessment	Examination: 60%
		Coursework: 40% - 2 class tests (40%)