Course Title	Multivariable Calculus
Course Code	MAT203
Course Type	Elective
Level	Bachelor (1st Cycle)
Year / Semester	4th Year / 7th Semester
Teacher's Name	TBA

ECTS	6	Lectures / week	3 hours / 14 weeks	Laboratories / week	N/A

Course Purpose and Objectives	An Introduction to Geometric Vector Analysis and Extension of Differential and Integral Calculus to Functions of Several Variables.
Learning Outcomes	Upon successful completion of the course, students will be able to: • Recognize the concept of a vector and appreciate its significance as a new tool for describing geometry. • Solve a large variety of problems on lines, planes, solids • Differentiate and integrate vector functions. • Recognize the concept of a function of several variables. • Practice partial derivatives and multiple integrals of functions of several variables and discuss their geometrical interpretations wherever applicable.

Prerequisites	MAT200	Co-requisites	None

Course Content	The Polar Coordinate System. From Polar to Rectangular Coordinates. From Rectangular to Polar Coordinates. Graphing in Polar Coordinates. Rules of Symmetry. Vectors in the Plane Vectors and Vector Operations. Geometric Definition of a Vector. Algebraic Definition of a Vector. The Triangle Inequality. The Dot Product. Angle Between Two Vectors. Orthogonality. Projections Vector Functions. Plane Curves and Parametric Equations. Cartesian Equation of a Plane Curve. The Equation of the Tangent Line to a Parametric Curve. The Differentiation and Integration of a Vector Function. Unit Tangent Vector. Unit Normal Vector. Arc Length. Parameter of Arc Length. The Rectangular Coordinate System in Space. Sphere. Three Dimensional Vectors. Direction of a Vector. Direction Cosines. The Dot Product. Angle Between Two Vectors. Parallel and Orthogonal Vectors. Projection. Lines in Three Dimensions. Vector Equation, Parametric Equations, and Symmetric Equations of a Line. The Cross Product of Two Vectors. Area of a Parallelogram. Volume of a Parallelepiped. Planes. Normal Vector. Parallel Planes. Distance From a Plane to a Point. Quadric Surfaces. Sphere. Right Circular Cylinder. Parabolic Cylinder. Elliptic Cylinder. Hyperbolic Cylinder. Ellipsoid. Hyperboloid of One Sheet. Hyperboloid of Two Sheets.

	Elliptic Paraboloid. Hyperbolic Paraboloid. Elliptic Cone. Vector Functions and Parametric Equations in Three Dimensions. Cylindrical and Spherical Coordinates. Functions of Two and Three Variables. Domain and Range. Contour Curves. Isothermal Curves.
	Equipotential Curves. Constant Profit Curves. Limits and Continuity. Rule for Nonexistence of a Limit. Continuity. Open Ball. Closed Ball.
	Partial Derivatives. Higher-Order Partial Derivatives. Equality of Mixed Partials. Differentiability and the Gradient. The Chain Rule. Tangent Planes, Normal Lines, and Gradients. Directional Derivatives and the Gradient. Maxima and Minima for a Function of Two Variables. Definition of Local Maxima and Minima. Critical Points. Saddle Point. Second Derivative Tests. Constrained Maxima and Minima - Lagrange Multipliers.
	Multiple Integration. Volume Under a Surface and the Double Integral. Integrability Over a Function. The Calculation of Double Integrals. Repeated Integral. Reversing the Order of Integration. Surface Area. The Triple Integral. Volume, Density, and Mass.
	Recent developments and contemporary issues pertaining to the subject-matter of the course.
Teaching Methodology	Face- to- face
Bibliography	Marsden, J. & Tromba, A. Vector Calculus, Freeman
	Spiegel, M. Schaum's Srs., ADVANCED CALCULUS
	McGraw Hill
	Stein, S., CALCULUS AND ANALYTIC GEOMETRY
	McGraw Hill
	Blanck, B. & Krantz, S., Calculus Multivariable, Wiley
	Briggs, W., Cochran, L. & Gillett, G., Calculus for Scientists and Engineers, Multivariable, Pearson
	Musa, S. & Santos, D. Multivariable and Vector Calculus, An Introduction, Mercury Learning and Information
Assessment	Examinations 90% Class Participation and attandance 10% 100%
Language	English