Course Title	**Multivariable Calculus**
Course Code	**MS-253**
Credit Hours	3 (3,0)
Category	Mathematics & Supporting
Prerequisite	GE-162: Calculus and Analytical Geometry
Co-Requisite	None
Follow Up	None

Course Learning Outcomes (CLOs)	At the end of the course, the students will be able to:	BT	PLO
	CLO1: Know the concepts and applications of multivariable calculus	C1 (Know)	1
	CLO2: Describe scalar and vector products related techniques.	C2 (Describe)	1
	CLO3: Identify and solve problems related to differentiation and integration.	C3 (Apply)	1,3
	CLO4: Know the concepts of divergence, curl, vector fields and related theorems.	C1 (Know)	1

Syllabus	**Topics**: Motivation and applications of the course, Rectangular coordinates in 3-space, spheres, cylindrical surfaces, Vectors, Scalar (dot) products, projections, Vector (cross) products, Parametric Equations of Lines, Planes in 3-space, Quadric surfaces, Spherical and cylindrical coordinates, Introduction to vector-valued functions, Calculus of vector-valued functions, Change of parameter, Arc length, Unit tangent , normal, and binormal vectors, Curvature, Functions of two or more variables, Limits, Continuity, Partial derivatives, Differentiability, Local Linearity, Differentials, The Chain rule, Directional derivatives and Gradients, Tangent planes and normal vectors, Maxima and minima of functions of two variables, Lagrange multipliers, Double integral, Double integrals over Nonrectangular Regions, Double integrals in Polar Coordinates, Parametric surfaces, Surface area, Triple integrals, Triple Integrals in Cylindrical and Spherical Coordinates, Divergence and Curl of vector valued functions, Line integrals, Conservative Vector Fields, Green's Theorem, Surface integrals, application of surface integrals(Flux), Divergence Theorem, Stokes' theorem.
Suggested Instructional/ Reading Material	Howard Anton, Irl C. Bivens and Stephen Davis, Calculus, 11th Edition, Wiley, 2016, ISBN-10: 1119228581, ISBN-13: 978-1119228585.