Course Title: Multivariable Calculus

Course Code: MATH-201

Course Type: Major Math

Prerequisites: Single Variable Calculus

Credit Hours: 3 (3 + 0)

Course Objectives:
After completion of this course, the students will be able to:

- Analyze three-dimensional vectors and surfaces.

- Apply calculus to vector-valued functions, including concepts such as arc length, curvature, and torsion.

- Utilize partial derivatives to solve optimization problems.

- Master the applications of multiple integrals and topics in vector calculus, including Green's, Stokes's, and the Divergence theorems.

Course Contents:

Preliminaries: Review of vectors in plane and space, Vector-valued function, Arc length, Curvature, Normal and binormal vectors, and Torsion.

Partial Derivatives: Functions of several variables, Limits and Continuity, Partial Derivatives, Higher order partial derivatives, Chain rule, Directional derivatives.

Applications of Partial Derivatives: Tangent planes and linear approximations, Gradient vector, Tangent planes and normal lines, Differentials and their applications, Maxima and minima of functions of two variables, Lagrange multipliers.

Multiple Integrals: Double integrals over rectangular domains and iterated integrals, Non-rectangular domains, Double integrals in polar coordinates, Triple integrals in rectangular, Cylindrical and spherical coordinates, Three dimensional solid and moments of inertia, Applications of double and triple integrals. Change of variables in multiple integrals.

Vector Calculus: Divergence of a vector field, Curl of a vector field, Line integrals, Integration around closed curves, Green's theorem, Surface integrals, Divergence theorem and Stokes's theorem.

Recommended Books:

1. Anton, H., Bevens, I. and Davis, S., *Calculus*, John Wiley & Sons, Inc., 12th edition, 2022.

2. Edward, C.H., *Calculus and Analytic Geometry*, Prentice Hall College Div., 3rd edition, 1990.

3. Hallett, D. H. and Gleason, A. M., *Calculus: Single and Multivariable*, Wiley, 8th edition, 2020.

4. Mendelson, E. and Ayres, F., *Calculus, Schaum's outlines series*, McGraw-Hill, 4th edition, 1999.

5. Thomas, G. B. and Finney, R. L., *Calculus*, Addison Wesley Publishing Company, 11th Edition, 2005.

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