University at Buffalo
Gifted Math Program
Graduate School of Education

Course VI Curriculum

MTH 241- College Calculus 3- Fall Semester

Textbook

Stewart, Calculus Early Transcendentals, MTH241 (8th edition), Cengage Learning

Catalogue Description:

Geometry and vectors of n-dimensional space; Green's theorem, Gauss theorem, Stokes theorem; multidimensional differentiation and integration; application to 2- and 3-D space. 4 credits

Weekly Topics

Week 1

Sections 12.1 – 12.4: Three-Dimensional Coordinate Systems, Vectors, Dot Product, Cross Product

Week 2

Sections 12.5 – 12.7: Equations of Lines and Planes, Cylinders and Quadratic Surfaces, Cylindrical and Spherical Coordinates

Week 3

Sections 13.1 – 13.3: Vector Functions and Space Curves, Derivatives and Integrals of Vector Functions, Arc Length and Curvature

Week 4

Sections 13.4, 14.1: Motion in Space: Velocity and Acceleration; Functions of Several Variables

Week 5

Sections 14.2 – 14.4: Limits and Continuity, Partial Derivatives, Tangent Planes and Linear Approximation

Week 6

Sections 14.5 – 14.7: Chain Rule, Directional Derivatives and Gradient Vector, Maximum and Minimum Values

Week 7

Sections 14,8,
15.1-15.2: Lagrange Multiplier, Double Integrals over Rectangles, Iterated Integrals

Week 8

Sections 15.3 – 15.5: Double Integrals over General Regions, Double Integrals in Polar Coordinates, Applications of Double Integrals

Week 9

Sections 15.6 – 15.8: Surface Area, Triple Integrals, Triple Integrals in Cylindrical and Spherical Coordinates
Option: Section 15.9 Change of Variables in Multiple Integrals

Week 10

Sections 16.1 – 16.4: Vector Fields, Line Integrals, Fundamental Theorem for Line Integrals, Green's Theorem

Week 11

Sections 16.5 – 16.7: Curl and Divergence, Parametric Surfaces and their Area, Surface Integrals

Week 12

Sections Sections 16.8 – 16.9: Stokes' Theorem, Divergence Theorem

MTH 309- Introduction to Linear Algebra- Spring Semester

Textbook

Peter Selinger, Matrix Theory and Linear Algebra, https://www.mathstat.dal.ca/~selinger/linear-algebra/

Catalogue Description

Linear equations, matrices, determinants, vector spaces, linear mappings, inner products, eigenvalues, eigenvectors. 4 credits

Topics

Linear Equations in Linear Algebra

Sections 1.1 – 1.8: Systems of linear equations. Row reduction and echelon forms. Vector equations. Ax-b. Solution sets of linear systems. Applications of linear systems. Linear independence. Linear transformations.

Matrix Algebra

Sections 2.1 – 2.3, 2.8 – 2.9: Matrix operations. Inverse of a matrix. Characterizations of invertible matrices. Subspaces of R^n. Dimension and rank.

Determinants

Sections 3.1 – 3.2: Introduction to determinants. Properties of determinants.

Vector Spaces

Sections 4.1 – 4.6: Vector spaces and subspaces. Null spaces, column spaces, and linear transformations. Linearly independent sets, bases. Coordinate systems. Dimension of a vector space. Rank.

Eigenvalues and Eigenvectors

Sections 5.1 – 5.5: Eigenvectors and eigenvalues. Characteristic equation. Diagonalization. Eigenvectors and linear transformations. Complex eigenvalues.

Orthogonality and Least Squares

Sections 6.1 – 6.5: Inner product, length, orthogonality. Orthogonal sets. Orthogonal projections. Gram-Schmidt process. Least squares problem.

Symmetric Matrices and Quadratic Forms

Sections 7.1 – 7.2: Diagonalization of symmetric matrices. Quadric forms.