Math 333–Calculus III
Course Syllabus

Course description: Vectors, vector operations, and vector functions; multivariate functions, partial derivatives, gradients, and multiple integrals; integration in vector fields, Green's, Stokes', and the Divergence theorems.

Credit hours: 4

Course Prerequisites and Corequisites: MTH 234

Course outline: Approximate time spent

- **Vector operations and vector functions** 20%
  - Vectors and vector operations
    - Definition, addition, scalar multiplication
    - Vector products: dot, cross, box
    - Lines and planes in space
  - Vector-valued functions
    - Limits and continuity; differentiation and integration
    - Arc length
    - Unit tangents and normals, curvature
- **Multivariate functions** 40%
  - Definitions, domain/range, surfaces, level curves/surfaces
  - Limits and continuity
  - Partial derivatives/implicit differentiation
    - The extended chain rule
    - Directional derivatives and gradients
    - Tangent planes
    - Extreme values
  - Multiple integrals
    - Double integrals, areas, moments and center of mass
    - Triple integrals, masses and moments
    - Substitution with multiple integrals, Jacobians
    - Integrals in other coordinate systems
- **Integration in vector fields** 40%
  - Line integrals
  - Vector fields: work and potential, circulation, flux
  - Green's Theorem: divergence and curl
  - Surface integrals
  - Stokes' Theorem
  - Divergence Theorem

Student Learning Outcomes (SLO): At the end of MTH 333, a student who has studied and learned the material should be able to:

1. Perform and interpret the standard vector operations. [PLO: 2]
2. Calculate and interpret the arc length, unit tangent vector, curvature, and principal unit normal of vector-valued functions parameterized either by time or arc length. [PLO: 2]
3. Demonstrate an understanding of the connection between the gradient of a multivariate function, directional derivatives, and tangent planes. [PLO: 1]
4. Set up, manipulate, transform, and interpret multiple integrals to solve mathematical and real-world problems. [PLO: 2,4]
5. Calculate line integrals in vector fields and relate these integrals to the notions of circulation and flux. [PLO: 2,4]
6. Use Green's Theorem to connect the flux of a vector field to its divergence and the circulation to the curl. [PLO: 1,2]
7. Calculate surface integrals and relate them to real-world applications. [PLO: 2,4]
8. Generalize Green's Theorem in the plane to Stokes' Theorem and the Divergence Theorem on surfaces. [PLO: 1,2]

Program Learning Outcomes (PLO):

Students graduating from SFASU with a B.S. Degree and a major in mathematics will:

1. Demonstrate comprehension of core mathematical concepts. [***Concepts***]
   (notion of theorem, mathematical proof, logical argument)
2. Execute mathematical procedures accurately, appropriately, and efficiently. [***Skills***]
   (calculus, algebra, routine, nonroutine, applied)
4. Demonstrate competence in using various mathematical tools, including technology, to formulate, represent, and solve problems. [***Problem Solving***]
   (calculus tools, algebra tools, applied tools, nonstandard problem solving)