22005 Analytic Geometry and Calculus III (4)

In a Calculus III course, students should:

- develop mathematical thinking and communication skills and learn to apply precise, logical reasoning to problem solving, as emphasized in the calculus renewal movement.
- be able to communicate the breadth and interconnections of the mathematical sciences through being presented key ideas and concepts from a variety of perspectives, a broad range of examples and applications, connections to other subjects, and contemporary topics and their applications.
- experience geometric as well as algebraic viewpoints and approximate as well as exact solutions.
- use computer technology to support problem solving and to promote understanding (e.g., graphics packages enhance multivariable calculus).
- for students in the mathematical sciences, progress from a procedural/computational understanding of mathematics to a broad understanding encompassing logical reasoning, generalization, abstraction, and formal proof; gain experience in careful analysis of data; and become skilled at conveying their mathematical knowledge in a variety of settings, both orally and in writing.

The successful Calculus III student should be able to:

1. Perform and apply vector operations, including the dot and cross product of vectors, in the plane and space. Graph and find equations of lines, planes, cylinders and quadratic surfaces .
2. Differentiate and integrate vector-valued functions. For a position vector function of time, interpret these as velocity and acceleration .*
3. Evaluate limits and determine the continuity and differentiability of functions of several variables. *
4. Describe graphs, level curves and level surfaces of functions of several variables.*
5. Find arc length and curvature of space curves, including the use of unit tangents and unit normals ; identify and interpret tangential and normal components of acceleration .
6. Find partial derivatives, directional derivatives, and gradients and use them to solve applied problems.*
7. Find differentials of functions of several variables and use them to solve applied problems.
8. Find equations of tangent planes and normal lines to surfaces that are given implicitly or parametrically.*
9. Use the chain rule for functions of several variables (including implicit differentiation).*
10. For functions of several variables, find critical points using first partials and interpret them as relative extrema/saddle points using the second partials test. Find absolute extrema on a closed region. Apply these techniques to optimization problems.*
11. Use Lagrange multipliers to solve constrained optimization problems.
12. Evaluate multiple integrals in appropriate coordinate systems such as rectangular, polar, cylindrical and spherical coordinates and apply them to solve problems involving volume, surface area, density, moments and centroids.*
13. Use Jacobians to change variables in multiple integrals.
14. Evaluate line and surface integrals. Identify when a line integral is independent of path and use the Fundamental Theorem of Line Integrals to solve applied problems.*
15. Identify conservative and inverse square fields.*

16. Find the curl and divergence of a vector field, the work done on an object moving in a vector field, and the flux of a field through a surface. Use these ideas to solve applied problems.*
17. Introduce and use Green's Theorem, the Divergence (Gauss's) Theorem and Stokes's Theorem.*

1,5,7,11,13 are optional topics in Ohio Transfer Module.