Spring 2019

Syllabus for Math 253A – Accelerated Calculus III

Course Description: Vector calculus, maxima and minima in several variables, multiple integrals, line integrals and Green's Theorem, surface integrals, Stokes' Theorem, Divergence Theorem.

Prerequisite: Math 252A, AP Calculus BC score of 4 or 5 and consent; or a grade of A in Math 242 and consent.

Text: Current Edition of *Calculus* by James Stewart.

Format: This four credit class meets for 200 minutes of lecture per week.

Caution: The course covers a lot of material. Good planning is required so that there is enough time to cover all the material.

Final Exam: The final exam will cover all the topics listed below.

Course objectives: This is an honors course. A successful Math 253A student will have an in–depth, computational as well as conceptual, understanding of the topics listed above, be able to solve routine and challenging problems, and be able to apply the ideas creatively.

Program objectives: This is the third and final course of the honors calculus sequence for STEM (Science, Technology, Engineering, Mathematics) majors. As this is an honors course, the approach is not just computational, but there is also an emphasis on concepts and theory. Mathematics is the basic language for STEM fields. Understanding the language, the basic ideas and results, and the computational techniques of calculus is prerequisite to advanced learning in any STEM field.

Approximate Timeline:

Weeks 1–2: Vectors and the geometry of space.

(1) Section 12.1: Three-dimensional coordinate systems.
(2) Section 12.2: Vectors.
(3) Section 12.3: The dot product.
(4) Section 12.4: The cross product.
(5) Section 12.5: Equations of lines and planes.
(6) Section 12.6: Cylinders and quadric surfaces.

Weeks 3 - 4: Vector functions.

(1) Section 13.1: Vector functions and space curves.
(2) Section 13.2: Derivatives and integrals of vector-valued functions.
(3) Section 13.3: Arc length and curvature.
(4) Section 13.4: Motion in space: velocity and acceleration (Kepler's Laws optional).

Weeks 5 - 7: Partial derivatives.

(1) Section 14.1: Functions of several variables.
(2) Section 14.2: Limits and continuity in higher dimensions.
(3) Section 14.3: Partial derivatives.
(4) Section 14.4: Tangent planes and linear approximations.
(5) Section 14.5: The chain rule.
(6) Section 14.6: Directional derivatives and the gradient vector.
(7) Section 14.7: Maximum and minimum values.
(8) Discovery Project p. 1011: Quadratic approximations.
(9) Section 14.8: Lagrange multipliers.

Weeks 8 - 10: Multiple Integrals.

(1) Review Section 12.5 and Section 12.6.
(2) Section 15.1: Double integrals over rectangles.
(3) Section 15.2: Double integrals over general regions.
(4) Section 15.3: Double integrals in polar coordinates.
(5) Section 15.4: Applications of double integrals.
(6) Section 15.5: Surface area (this section can be skipped as surface area is covered again in Section 16.7).
(7) Section 15.6: Triple integrals.
(8) Section 15.7: Triple integrals in cylindrical coordinates.
(9) Section 15.8: Triple integrals in spherical coordinates.
(10) Section 15.9: Change of variables in multiple integrals.

Weeks 11 - 15: Vector calculus.

(1) Section 16.1: Vector fields.
(2) Section 16.2: Line integrals.
(3) Section 16.3: The Fundamental Theorem for Line Integrals.
(4) Section 16.4: Green's theorem.
(5) Section 16.5: Curl and divergence.
(6) Section 16.6: Parametric surfaces and their areas.
(7) Section 16.7: Surface integrals.
(8) Section 16.8: Stokes' Theorem.
(9) Section 16.8: The Divergence Theorem.