RUTGERS
UNIVERSITY | NEWARK

HONORS CALCULUS I & II
21:640:155 & 21:640:156 (4 credits, 4 credits)

COURSE DESCRIPTION:
Covers material selected from 21&62:640:135 (Calculus I) and 21:640:136 (Calculus II) in greater depth with emphasis on mathematical rigor. These courses will rigorously cover the theory and applications of differential and integral calculus. Substantially more material with deeper applications will be covered than in the regular calculus sequence.

PREREQUISITE:
Invitation by department based on placement examination. Open to all majors.

TEXTBOOK:
"Calculus," (4th edition), by Spivak, published by Publish/ Perish.

DEPARTMENT WEB SITE: http://www.ncas.rutgers.edu/math

HONORS CALCULUS I & II COVER THE FOLLOWING CHAPTERS & SECTIONS:

Honors Calculus I:

Part 1:
Methods of proof: Mathematical induction, Proof by contradiction.
Basic properties of numbers: order, absolute value, Schwarz inequality.

Part 2:
Foundations of analysis: Functions, graphs, vectors, polar coordinates. A rigorous treatment of limits, continuous functions, Least Upper Bound Axiom with applications, Archimedean and non-Archimedean fields, uniform continuity.

Part 3:
Derivatives and Integrals: Definition and calculation of derivatives, rules of differentiation, introduction to trigonometric functions, Mean Value Theorem and applications to approximations with error estimates, increasing and decreasing functions, minima/maxima, convexity, and L'Hospital's Rule. Inverse functions, introduction to inverse trigonometric functions, definition of the integral on a closed interval, calculation of various integrals using the definition, proofs that continuous functions are integrable, properties of the integral, the First Fundamental Theorem of Calculus, the Second Fundamental Theorem of Calculus, the logarithm and exponential functions, more on trigonometric functions and their inverses.

Honors Calculus II:

Part 3 Cont.:

Pi is irrational, planetary motion: Kepler's Laws (optional), integration in elementary terms (techniques of integration): Substitution, integration by parts, reduction formulas, trig integrals, rationalizing substitutions, integration of rational functions, Improper integrals, the Gamma function, volumes of solids, "disks" and "shells."

Part 4:

Infinite sequences and infinite series: Taylor's Theorem, approximation by polynomial functions, sequences and series, various convergence tests, uniform convergence and power series, complex numbers, complex functions, complex power series, the Fundamental Theorem of Algebra, Fourier series, Lebesgue's proof of the completeness of the trigonometric system, various convergence theorems for Fourier series.

Department of Mathematics & Computer Science
Smith Hall 216, 101 Warren Street, Newark, New Jersey 07102
Phone: (973) 353-1004 Fax: (973) 353-5270