	Fall 2014 **MAT 319: Foundations of Analysis**	Fall 2014 **MAT 320: Introduction to Analysis**
Schedule	TuTh 10:00-11:20 **Library E4310 (CHANGE)** (through 10/2: joint lectures in Math P-131)	TuTh 10:00-11:20 Math P-131
Instructor	Samuel Grushevsky	David Ebin
Office hours	Tu 11:30-12:30 in Math P-143, Tu 2:00-3:30 and Th 11:30-12:00 in Math 3-109	Tu, Th 11:30-1:00 in Math P-143
Recitation	MW 11:00-11:53 Harriman 112	MW 11:00-11:53 Lgt Engr Lab 152
TA	Apratim Chakraborty	Chengjian Yao
Office hours	MW 2:00-3:00, Th 4:00-5:00 in MLC	W 4:00-6:00 in MLC, W 3:00-4:00 in Math 2-105
Description	A careful study of the theory underlying topics in one-variable calculus, with an emphasis on those topics arising in high school calculus. The real number system. Limits of functions and sequences. Differentiations, integration, and the fundamental theorem. Infinite series.	A careful study of the theory underlying calculus. The real number system. Basic properties of functions of one real variable. Differentiation, integration, and the inverse theorem. Infinite sequences of functions and uniform convergence. Infinite series.
Overview	The purpose of this course is to build rigorous mathematical theory for the fundamental calculus concepts, sequences and limits, continuous functions, and derivatives. We will rely on our	An introductory course in analysis, required for math majors. It provides a closer and more rigorous look at material which most students encountered on an informal level during their first two

	intuition from calculus, but (unlike calculus) the emphasis will be not on calculations but on detailed understanding of concepts and on proofs of mathematical statements.	semesters of Calculus. Students learn how to write proofs. Students (especially those thinking of going to graduate school) should take this as early as possible.
Prerequisites	C or higher in MAT 200 or permission of instructor; C or higher in one of the following: MAT 203, 205, 211, 307, AMS 261, or A- or higher in MAT 127, 132, 142, or AMS 161. *Math majors are required to take either MAT 319 or MAT 320*	
Textbook	Kenneth Ross *Elementary Analysis: The Theory of Calculus*, **2nd edition**	
Homework	Weekly problem sets will be assigned, and collected in *Wednesday recitation*. The emphasis of the course is on writing proofs, so please try to write legibly and explain your reasoning clearly and fully. You are encouraged to discuss the homework problems with others, but your write-up must be your own work. *Late homework will never be accepted*, but under documented extenuating circumstances the grade may be dropped.	
Grading	Homework: 20%, Midterm I: 20%, Midterm II: 20%, Final: 40%.	

Syllabus/schedule (subject to change)

All joint lectures through 10/2 meet in Math P-131.
First recitation on Wed 8/27, second recitation Wed 9/3.
During joint lectures through 10/2, students with last names starting A-O attend recitation in Harriman 112, students with last names P-Z attend recitation in Lgt Engr Lab 152
Recommendations on choosing MAT 319 vs MAT 320 will be made based upon your performance on the first midterm and homework to that date.

1.	Joint class: Introduction,	Read pages 1-19

	motivation: what are real numbers? (Ebin)	
2.	Joint class: Properties of numbers; induction; concept of a field. (Ebin)	**HW due 9/3:** 1.3, 1.4, 1.10, 1.12, 2.2, 2.5, 3.1, 3.4, 3.6
	No class: day after Labor Day	
3.	Joint class: Completeness axiom for real numbers; Archimedean property. (Ebin)	Read pages 20-27; **HW due 9/10:** parts eghimr of: 4.1,4.2,4.3,4.4; and 4.8,4.10,4.11,4.12,4.14
4.	Joint class: Infinity, unboundedness. Intro to sequences. (Ebin)	Read pages 28-38
5.	Joint class: Limit of a sequence. (Ebin)	**HW due 9/17:** 5.2, 5.6, 7.3, 7.4, 8.1ac
6.	Joint class: Limit laws for sequences. (Grushevsky)	Read pages 39-55
7.	Joint class: Divergence to infinity, more formal proofs. (Grushevsky)	**HW due 9/24:** 8.3, 8.6, 8.8, 8.10, 9.1, 9.3, 9.5, 9.12, 9.14
8.	Joint class: Monotone and Cauchy sequences.	Read pages 56-65

	(Grushevsky)	
9.	Joint class: Subsequences. (Grushevsky)	**No HW: prepare for the midterm**
	Joint Midterm I in Math P-131.	Practice midterm 1, Practice midterm 2, Practice midterm 2 solutions
10.	Joint class: Subsequences. (Grushevsky)	**HW due 10/8:** 10.1, 10.2, 10.5, 10.8, 10.9, 11.2, 11.4, 11.5, 11.8, 11.9
	Everything from here on is for MAT320 only	
11.	Limsup and Liminf, Bolzano-Weierstrass, Metric spaces and $\mathbf{R}^n$ as a metric space	Read pages 66-77
12.		**HW due 10/15:**12.1, 12.2, 12.4, 12.5, 12.9ab, 12.10, 12.14, 13.1, 13.3, 13.4
13.		Read pages 78-87
14.		**HW due 10/22:** nothing due this week
15.		Read pages 90-104
16.		**HW due 10/29:** 13.8b, 13.9, 13.11, 13.12, 13.14, 14.1ace, 14.3ace, 14.6, 14.12, 14.13
17.		Read pages 105-122
18.		**HW due 11/5:** 15.2, 15.3, 15.7, 16.4acd, 16.9, 17.1ac, 17.2, 17.4, 17.8, 17.14
		Second midterm on November 13 Possible topics for the exam:

19.		equivalence relations and equivalence classes; natural numbers, integers, rational numbers, algebraic numbers, real numbers (a complete ordered field) and complex numbers; absolute value;max, min sup and inf for subsets of the real numbers; Archimedian property; positive numbers have square roots; sequences and series and their properties; Bolzano Weierstrass theorem; inner product and norm for R^n; Schwartz inequality; metric spaces; R^n as a metric space; completeness for metric spaces; Compactness; Heine-Borel theorem; Is a bounded complete metric space necessarily compact; open and closed sets in a metric space; ratio test for convergence of series; harmonic series; convergence of alternating series; exponential function of a complex variable called E(z); E(z+w) = E(z) E(w); sine and cosine from E(ix); Continuity of a function from one metric space to another;
20.		Read pages 126 -143
21.		**No HW due** November 12. review for exam
22.		**HW due 11/19** 17.15, 18.3, 18.5a, 18.9, 18.12b
23.		Read pages 145-154 We did not do all of this in classs because it is rather routine, but you are responsible for it

24.		**HW due 11/24** 19.1acde, 19.4, 19.7, 20.14, 20.17
25.		Read pages 205-220 and 243-265

Final Exam: Friday December 12, 11.15AM-1.45PM

Practice final for 319

Disability Support Services: If you have a physical, psychological, medical, or learning disability that may affect your course work, please contact Disability Support Services (DSS) office: ECC (Educational Communications Center) Building, room 128, telephone (631) 632-6748/TDD. DSS will determine with you what accommodations are necessary and appropriate. Arrangements should be made early in the semester (before the first exam) so that your needs can be accommodated. All information and documentation of disability is confidential. Students requiring emergency evacuation are encouraged to discuss their needs with their professors and DSS. For procedures and information, go to the following web site http://www.ehs.sunysb.edu and search Fire safety and Evacuation and Disabilities.

Academic Integrity: Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instance of academic dishonesty to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/.

Critical Incident Management: Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, and/or inhibits students' ability to learn.