

SAMPLE SYLLABUS

NOTE: This document is published only as an indication of what is typically taught in this course. Instructors have the responsibility of deciding on topics to be omitted, additional topics to be included, and the emphasis, ordering, and pacing of presentation of topics.

- Course Number: **MTH 311 (formerly MTH 301)**
- Course Title: **Intro. to Higher Mathematics**
- Credit Hours: 4.0
- Textbook(s): Choice of instructor.
The Undergraduate Studies office has library of possibilities.
- Description: MTH 311 is our "transition course" from calculus to advanced mathematics. The primary purpose of the course is to develop the students' ability to read, comprehend and construct rigorous proofs.
- Prerequisite: MTH 241
- Syllabus: Core material:
1. The number systems and the existence of irrational numbers.
 - a) Algebraic properties: axioms for an ordered field and basic theorems.
 - b) Decimal expansions and repeating decimals.
 2. Sets and functions.
 - a) Operations and Relations: Union, intersection, complement; containment.
 - b) Empty set and power set; Cartesian product.
 - c) de Morgan's laws.
 - d) Domain, codomain, image, inverse image.
 - e) Injectivity, surjectivity, bijectivity and inverses; composition of functions.
 3. Size of sets (finite/infinite, countable/uncountable), the countability of the rationals and the uncountability of the real numbers.
 4. Boundedness, upper and lower bounds, lub's and glb's, lub and glb property, density of the rationals in the reals, Archimedean property of the reals.
 5. Mathematical induction, including strong induction and the well-ordering of the natural numbers.
 6. Sequences of real numbers, including the Monotone Convergence Theorem, Cauchy sequences, and the Bolzano-Weierstrass Theorem.
- How the remainder of the course is to be filled is left to the individual instructor.
- Instructors should choose material that is, in their opinion, the best at teaching how to read, find and write sophisticated proofs in a way that they can make entertaining.
- Skills: There is primary importance in fostering the development of mathematical maturity and skills. The topics listed below should be covered in the course, not as material per se, but rather as skills to be mastered by applying them to the material covered.
- Core Skills:
1. Some informal logic
 - a) negation, conjunction, disjunction
 - b) conditional, biconditional
 - c) existential and universal quantifiers, negation of quantifiers, order of quantifiers
 - d) converse and contrapositive
 2. Methods of Proof
 - a) careful reading of definitions, theorems
 - b) structure of proposition: hypothesis and conclusion
 - c) direct and indirect proofs

Additional information: The April 2004 report of a committee on MTH 311 (then MTH 301) syllabus is available from the Main Office. It includes a list of some additional topics that have been taught by various instructors. Additional copies of this report are available from the Undergraduate Studies office.