WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**MATH 307 – History of Mathematics**

**Course Overview**

**Course Description**

General view of the historical development of the elementary branches of mathematics. *Prerequisites*:  Math 140 – Applied Calculus or Math 212 – Calculus I. Offered every fall and spring semester.

**Catalog Description**:

General view of the historical development of the elementary branches of mathematics.

**Goal Area 7 Requirements:**

This course is designated as a Goal Area 7 course – Human Diversity. Throughout the course, students will engage in discussions and course projects focusing on the important figures and individuals that contributed to the development of mathematics. Part of this story are those individuals or groups who may have been excluded for various reasons. Students will consider the implications for whether exclusionary practices (purposely or not) still exist, specifically thinking about these in relation to their American schools. Students will think about in what ways American schools as an institution and mathematics instruction may create greater inclusion or exclusion in the learning mathematics related to various population subgroups.

**Assessment Items:** will include in exams (in-class or take home), projects, and papers in which students must demonstrate the proficiency in the aforementioned student learning outcomes.

**Overarching Goals:**

The purpose of this course is to develop students’ understanding of the historical development of important mathematical ideas, procedures (e.g. algorithms) and practices (e.g. proving) primarily in the K-12 mathematics curriculum. The primary goal of this course is to further solidify students’ understanding of mathematics through the stories of mathematics history with special attention to the foundations of mathematics, and the roles that different cultures and individuals played in influencing the development of mathematics.

The course is centered around three key questions we will be thinking about throughout the semester are:

1. *What is mathematics?*
2. *How did what we consider mathematics today, come to be?*
3. *What is the history of the development of the content of K-12 mathematics?*

**Recommended textbooks for the course**

* *Math through the Ages: A Gentle History for Teachers and Others,* by Berlinghoof and Gouvea.
* *The History of Mathematics: An introduction,* by Burton
* *The Millenium Problems: A Brief Course,* by Devlin
* *Journey through Genius: The Great Theorems of Mathematics*, by Dunham
* *Great Feuds in Mathematics: Ten of the Liveliest Disputes Ever*, by Hal
* *A History of Mathematics: An Introduction*, by Katz
* *A History of Mathematics:* by Suzuki
* *Mathematical Thought: From Ancient to Modern Times*, by Kline

**Minnesota Board of Teaching Standards Addressed:**

* 3.B.4 (exploration, development, analysis, and comparison of algorithms designed to accomplish a task or solve a problem)
* 3.B.1.e (apply properties of boundedness and limits to investigate problems involving sequences and series)
* 3.B.2.a (application of discrete models to problem situations using appropriate representations including sequences, finite graphs,, trees, matrices, and arrays)
* 3.B.2.c (application of discrete mathematics strategies including pattern searching; organization of information; sorting; case-by-case analysis; iteration and recursion; and mathematical induction to investigate, solve, and extend problems)
* 3.G.1.a (formulating and posing problems)
* 3.G.1.b (solving problems using different strategies, verifying and interpreting results, and generalizing the solution)
* 3.G.1.c (using problem solving approaches to investigate and understand mathematics)
* 3.G.4.a (demonstrating the interconnectedness of the concepts and procedures of mathematics)
* 3.G.4.b (making connections between mathematics and other disciplines)
* 3.H.1 (understand the historical bases of mathematics, including the contributions made by individuals and cultures, and the problems societies faced that gave rise to mathematical systems)
* 3.H.2 (recognize that there are multiple mathematical world views and how the teacher’s own view is similar to or different from that of the students)
* 3.H.3.a (processes and consequences of expanding mathematical systems)

**Student Learning Outcomes**

* Students will understand and appreciate how modern mathematics was influenced by its historical foundations.
* Students will understand and appreciate the creativity and mathematical sophistication of ancient mathematicians (before 300 AD).
* Students will understand and appreciate how much of undergraduate level mathematics was created/discovered by ancient mathematicians.
* Students will understand and appreciate how the early development of mathematics and mathematical rigor as we define it today stands apart from the timeline of development of other intellectual pursuits (medicine, chemistry and biology in particular) which did not make similar level of advances until much later in the timeline of history.
* Students will understand the impact of major events in world history (wars; rise and fall of cultures, nations and religions; economic collapse and prosperity) on the development of mathematics.
* Students will understand and will be able to place in time the major trends and shifts in the development of mathematics (*e.g.* the development of geometry in ancient Greece, the rise of algebra in Arabic cultures after the collapse of the Greek empire, the loss of mathematics during the Dark Ages, the rebirth of mathematics with the Renaissance, etc.)
* Students will be able to identify and categorize the most significant mathematicians and the most significant mathematical theorems.
* Students will understand and appreciate how the history of science and technology are linked to the history of mathematics.

**Timeline and List of Topics Covered:**

Week 1: Philosophical Perspectives on Mathematics & Foundations of Mathematical Thought

Week 2: Different numbering systems:

Mayans, Babylonians, Romans, Egyptians, Hindu, Incan, Chinese

Week 3: History of Prime Numbers

 Fundamental Theorem of Arithmetic

 Euclidean Algorithm for finding the Greatest Common Factor

 Infinitude of Primes

Week 4: Expanding the Number System Part I: History of Negative Numbers

Week 5: Expanding the Number System Part II: Irrational Numbers

Week 6: Expanding the Number System Part III:

Complex numbers, Countably and Uncountably infinite sets

Week 7: Solid Geometry – Greek Schools 1800 BC – 300 BC

 Unsolved problems in Classic geometry

Week 8: An overview of plane geometry

Pythagorean Theorem

Quadrature of the lune

 Archimedes and the area of a circle

 Heron’s Formula

Week 9: Early Algebra

 History of Al Khwarizmi

 Coordinate Geometry

Week 10: Advances in Algebra

 Binomial Theorem

 Cardano and the solution of the cubic

 Logarithms

Week 11: Early Calculus:

 Historical developments by Leibniz, Newton, and others

 Descartes’ Lost Calculus

Week 12: Calculus

Infinite sums (Euler)

 Harmonic series

 Brachistochrone Problem

Week 13: Early 20th Century Contributions

 Einstein’s Formula E = mc2

 Central Limit Theorem

 Russell’s Paradox

Week 14: Late 20th Century Contributions

 Public key Cryptography

 Google Page Rank Algorithm

 Big Data

**Last Revised:** Spring 2019 by the Math Ed Subgroup