

MATH 420 – HIGHER MATHEMATICS FOR TEACHERS

COURSE SYLLABUS

1. Course Information

- a. *Number:* MATH 420
- b. *Credits:* 5
- c. *Prerequisite:* MATH 201 **and** EDUC 210
- d. *Corequisite:* none
- e. *First Offered:* Winter 2015-16.
- f. *Meeting Room and Times:* Stevenson Building – Room 114
Monday, Wednesday, and Friday – 9:00-10:20

2. Personal Information

- a. *Instructor:* Dr. Terry Souhrada
- b. *Office Location:* Education Building – Room 104
- c. *Telephone:* (406) 275-4764
- d. *Office Hours:* Monday-Friday – 10:30 – 12:00 and by appointment

3. Required Materials

- a. *Text:* Crisler and Froelich. (2006). *Discreet Mathematics Through Applications, 3rd Ed.* New York, NY. W.H. Freeman and Company.
- b. *Technology:* graphing calculator and/or graphing utility and access to spreadsheet and word processing applications

4. Description

Higher Mathematics for Teachers follows MATH 201 (Introduction to Abstract Mathematics) and continues to explore concepts, processes, and proof relevant to higher levels of mathematics, including number theory, abstract algebra, combinatorics and probability. This course is designed specifically to focus on the content knowledge requirements of the NCTM and Common Core State Standards for Mathematics for preparation of secondary school mathematics teachers.

5. Course Objectives

Upon completion of this course students will:

1. General Course Objectives
 - a. explore, conjecture, and prove mathematical principles from various content areas of higher mathematics.
 - b. become proficient in the language and notation of mathematics.
 - c. identify connections between higher mathematics and secondary school mathematics.
 - d. convey mathematical meaning through writing.
 - e. examine the historical figures and their role in the development of various mathematical content areas.

2. Critical Thinking
 - a. develop the ability to observe, conjecture, and validate conjectures through mathematical argument and proof.
 - b. be able to evaluate the quality of an argument in terms of validity, accuracy, and reasonability.
 - c. validate their work with clear organization and explanation.
3. Cultural Relevancy
 - a. accept and appreciate a variety of mathematics backgrounds and abilities.
 - b. increase understanding of their own strengths and methods through interaction with a diverse group of learners.
 - c.

6. Course Requirements

- a. periodic homework assignments
- b. exams (midterm and comprehensive final)
- c. capstone project focused around self-selected mathematical content

7. Credit Hours

Following the SKC Credit Hour policy, to meet the identified objectives of this course, this 5 credit course, delivered over a 10-week term will approximate:

- a. 5 hours/week classroom instruction
- b. In addition, out-of-class student work will approximate a minimum of 10 hours per week.

8. Grading

- a. An Incomplete grade (“I”) is NOT an option with the exemption of an extreme emergency or the death of a family member. In either case, the instructor must be notified within 48 hours and has sole discretion in its granting
- b. Your final grade will be determined as outlined below.

homework	40	A → $90 \leq \text{grade} \leq 100$
exams	50	B → $80 \leq \text{grade} < 90$
capstone project	<u>60</u>	C → $70 \leq \text{grade} < 80$
Total Points	150	D → $60 \leq \text{grade} < 70$
		F → grade < 60

If for any reason work is to be handed in after an identified deadline, previous arrangements must have been made with the instructor *prior* to the deadline. Late work *will not be accepted* if not prearranged. \

9. Attendance/Class Policies

Although no attendance points will be given, you will be expected to be in class on time. You are expected to stay in class until the designated time set for dismissal. If you must leave early inform the instructor *prior to the start of class*.

Class time is not a time to be engaged in personal communications. Use of cell phones/personal communication devices is strictly to carry out class requirements. So all devices should be in *silenced mode* during class

For you to get the most from this course full participation is a necessity. Being a fully participating member in this course requires that you come with the materials, tools, and any completed assignments necessary for each class period. **Students are responsible for coming prepared to class.**

There will be many activities and assignments you will not be able to make up due to the nature of the assignment. This is a course designed to help you prepare to be a professionally engaged teacher. Teachers are required to be in school at all times and on time. Consistent attendance is evidence that you are willing accept the responsibilities expected of a professional educator. This is professional responsibility. Poor attendance will result in missed information, missed assignments and tests, and possible failure of the course as well as a reflection of your professional disposition.

Additionally, you will be observing current classrooms. These teachers allow you to enter their classroom as a professional courtesy and to help you further your education. Be in their classroom on the agreed upon dates and on time. Be prompt, courteous, respectful, and professionally dressed when attending their classes. You are a guest in their classroom and a representative of the SKC Education Division. Represent yourself and the college professionally and courteously.

10. Other:

Academic Honor Code

All course work shall follow the guidelines of the Academic Honor Code as set forth by the SKC Student Handbook. Do your own work; allow other students to do their own work. **Plagiarism** involves the taking of someone else's words, ideas, or writings and presenting them as your own. Avoid plagiarism, and always acknowledge the ideas of others and cite your sources of information. Violation of the Academic Honor Code may result in failure of the assignment, the course, or possible expulsion from school.

Course Responsibilities

Knowledge of the course content, class lectures, assignments, activities, and syllabus content are the responsibility of the student regardless of absenteeism. Syllabus content and calendars are tentative; instructors will notify you of any changes.

Instructional Methodologies

The methodologies of instruction in this course will follow a constructivist format and use techniques of inquiry, construction of knowledge, discussions, lecture, and independent practice as well as other instructional practices. One such practice is the effective and appropriate instructional use of technology to enhance learning experiences.

Available Help

Reasonable accommodations are provided for eligible students with identified disabilities. The College complies with the Rehabilitation Act of 1973 and the Americans with Disabilities Act. Students may contact the College's Disability Officer, Stanley Fleming (stanley_fleming@skc.edu, 406.275.4968) or consult the SKC web page for Students with Disabilities for more information.

Student Safety and Title IX

Title IX: The U.S. Department of Education's Office for Civil Rights (OCR), enforces Title IX of the Education Amendments of 1972. Title IX protects people from discrimination based on sex in education programs or activities that receive Federal financial assistance. Title IX states that:

No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.

All employees at SKC are considered "**Responsible Employees**" which requires them to report incidents of gender-based discrimination (sexual violence, sexual harassment, rape, sexual assault, domestic violence, and/or stalking). In accordance with Title IX laws, students must be made aware of the following: If any employee of SKC, including instructors, learns of any potential gender-based discrimination, they are required to notify the Title IX Coordinator, **Rachel Andrews-Gould** (275-4985, located in Big Knife Building), immediately. Once an incident is reported to Title IX, the student will be contacted by the Title IX Coordinator for follow up. Students can also report directly to the Title IX coordinator in regards to any gender-based discrimination.

If any student wants to speak with someone confidentially, the following resources are available:

Center for Prevention and Wellness Agnes Kenmille Building (#51) 406.275.4913 or 406.275.4744	SAFE Harbor Advocacy Services 24-Hour Advocacy 406.676.0800
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Speaking with a confidential resource does not preclude students from making a formal report to the Title IX Coordinator if and when they are ready. In the confidential setting, students will be made aware of available resources and reporting options. An advocate is available for all students upon request through the Center for Prevention and Wellness.

SKC Retention

The SKC Retention Team consists of SKC staff and faculty who provide student-centered support services on a daily basis. The SKC Retention Team is here to help you to be successful in reaching your educational goals. You can contact the SKC Retention Team yourself, or your instructor may refer you (for example, if you "disappear" from class or they are concerned about your attendance and performance).

Syllabus Revision

The faculty reserves the right to revise the course syllabus or course content at any time. Students will be provided advanced notice of changes in writing.

11. Course Outline

Below each week is listed with an intended focus for that week. This schedule is tentative and subject to change. You will be notified of such changes as much in advance as possible.

Week 1 – Introduction – Why Higher Mathematics – What Content – Intuition and Proof– Introduction to Project Guidelines

Week 2 – Basics of Number Theory

Week 3 – Number Theory Continued – Theory of Equations – Review of Project Plan

Week 4 – Building the Real Number System – Historical Development of the Real Number System

Week 5 – Building the Complex Numbers – Historical Development and Uses of the Complex Numbers – *Midterm Exam* – Draft of Project Due

Week 6 – Combinatorics and Probability–

Week 7 – Induction and Recursion

Week 8 – Fractals – Chaos Theory

Week 9 – Graph and Network Theory – Project Due

Week 10– Three Problems of Antiquity – Project Presentations – *Final Exam*

12. Standards Addressed

The content and assessment within this course, as with all the courses included as part of the Bachelor of Science in Secondary Education – Mathematics (BSSEM) degree program, is guided by various sets of standards. These standards serve as the goals and learning outcomes established for this course.

Below are the standards to be addressed within this course. You may receive a complete copy of these standards upon your request.

InTASC Standards

Standard #4: Content Knowledge

The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make these aspects of the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content

The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

NCTM – 2012

Preservice teacher candidates

- 1a)** Demonstrate and apply knowledge of major mathematics concepts, algorithms, procedures, applications in varied contexts, and connections within and among mathematical domains.

Specifically from the Mathematics Content for Secondary Addendum:

- A.1.1 Structure, properties, relationships, operations, and representations including standard and non-standard algorithms, of numbers and number systems including integer, rational, irrational, real, and complex numbers
- A.1.2 Fundamental ideas of number theory (divisors, factors and factorization, primes, composite numbers, greatest common factor, least common multiple, and modular arithmetic)
- A.1.4 Vector and matrix operations, modeling, and applications
- A.1.5 Historical development and perspectives of number, number systems, and quantity including contributions of significant figures and diverse cultures
- A.2.6 Abstract algebra, including groups, rings, and fields, and the relationship between these structures and formal structures for number systems and numerical and symbolic calculations
- A.2.7 Historical development and perspectives of algebra including contributions of significant figures and diverse cultures
- A.3.3 Congruence, similarity and scaling, and their development and expression in terms of transformations
- A.3.6 Identification, classification into categories, visualization, and representation of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, prisms, pyramids, cones, cylinders, and spheres)
- A.3.7 Formula rationale and derivation (perimeter, area, surface area, and volume) of two- and three-dimensional objects (triangles, quadrilaterals, regular polygons, rectangular prisms, pyramids, cones, cylinders, and spheres), with attention to units, unit comparison, and the iteration, additivity, and invariance related to measurements
- A.3.10 Historical development and perspectives of geometry and trigonometry including contributions of significant figures and diverse cultures
- A.4.2 Creation and implementation of surveys and investigations using sampling methods and statistical designs, statistical inference (estimation of population parameters and hypotheses testing), justification of conclusions, and generalization of results
- A.4.3 Univariate and bivariate data distributions for categorical data and for discrete and continuous random variables, including representations, construction and interpretation of graphical displays (e.g., box plots, histograms, cumulative frequency plots, scatter plots), summary measures, and comparisons of distributions

- A.4.4 Empirical and theoretical probability (discrete, continuous, and conditional) for both simple and compound events
 - A.4.5 Random (chance) phenomena, simulations, and probability distributions and their application as models of real phenomena and to decision making
 - A.5.3 Sequences and series
 - A.6.1 Discrete structures including sets, relations, functions, graphs, trees, and networks
 - A.6.2 Enumeration including permutations, combinations, iteration, recursion, and finite differences
 - A.6.3 Propositional and predicate logic
 - A.6.4 Applications of discrete structures such as modeling and solving linear programming problems and designing data structures
 - A.6.5 Historical development and perspectives of discrete mathematics including contributions of significant figures and diverse cultures
- 2a)** use problem solving to develop conceptual understanding, make sense of a wide variety of problems and persevere in solving them, apply and adapt a variety of strategies in solving problems confronted within the field of mathematics and other contexts, and formulate and test conjectures in order to frame generalizations.
- 2b)** reason abstractly, reflectively, and quantitatively with attention to units, constructing viable arguments and proofs, and critiquing the reasoning of others; represent and model generalizations using mathematics; recognize structure and express regularity in patterns of mathematical reasoning; use multiple representations to model and describe mathematics; and utilize appropriate mathematical vocabulary and symbols to communicate mathematical ideas to others.
- 2d)** organize mathematical thinking and use the language of mathematics to express ideas precisely, both orally and in writing to multiple audiences.
- 2e)** demonstrate the interconnectedness of mathematical ideas and how they build on one another and recognize and apply mathematical connections among mathematical ideas and across various content areas and real-world contexts.

PEPP Standards

10.58.501 General Requirements

- (1) All programs require that successful candidates:
 - (b) demonstrate understanding of the central concepts, tools of inquiry, and structure of the discipline(s) he or she teaches and creates learning experiences that make subject matter meaningful for students;
 - (k) demonstrate continued growth in knowledge related to a particular subject area and the teaching of it; and

10.58.518 Mathematics

- (1) The program require that successful candidates:
 - (a) demonstrate knowledge and understanding of and apply the process of mathematical problem solving;
 - (b) reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry;
 - (c) communicate mathematical thinking orally and in writing to peers, faculty, and others;
 - (d) recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding;
 - (e) use varied representations of mathematical ideas to support and deepen mathematical understanding;
 - (f) appropriately use current and emerging technologies as essential tools for teaching and learning mathematics; and
 - (g) support a positive disposition toward mathematical processes and mathematical learning.
- (3) The program require that successful candidates demonstrate content knowledge in:
 - (a) numbers and operations by demonstrating computational proficiency, including a conceptual understanding of numbers, ways of representing number relations among number and number systems, and meanings of operations;
 - (b) different perspectives on algebra including ways of representing mathematical relationships and algebraic structures;
 - (c) geometries by using spatial visualization and geometric modeling to explore and analyze geometric shapes, structures, and their properties;
 - (e) discrete mathematics by applying the fundamental ideas of discrete mathematics in the formulation and solution of problems;