

MATH/MTH 5301 Syllabus
Special Topics: Groups and Fields
Summer 2 2026 Sul Ross State University

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| MATH 5301, Sec. 2V1 | M, Tu, W, Th, F: 1-2:40 pm in ACR 206 or |
| MTH 5301, Sec. 2V1 | M, Tu, W, Th, F: 1-2:40 pm Interactive TV |
| Instructor: | Dr. Kris Jorgenson |
| Office: | ACR 109D |
| E-mail: | kjorgenson@sulross.edu |
| Office Hours: | M, Tu, W, Th, F: 11a-12p, 2:45-4:00p |
| | also by appointment |

Student Learning Objectives Students will gain understanding of rings, fields, and groups in part by the study of such underlying concepts as congruence, congruence classes, and quotient structures. Students will study examples of rings including the integers, polynomial rings, and fields. Students will use various methods of logical proof such as direct, indirect, and inductive arguments in the writing of their own original proofs. Applications to public-key cryptography will be studied employing such tools as modular arithmetic, the Euclidean algorithm, finite fields, finite groups, RSA methods and Elliptic Curve Cryptology. Students will express their solutions clearly in writing and use complete sentences when appropriate.

Prerequisites: It is preferred that students have a proof-writing course such as MATH 3340 (Foundations of Higher Mathematics) or MATH 3301 (Geometry), and MATH 4330 (Abstract Algebra or Modern Algebra) or MATH 2318 (Linear Algebra), but instructor approval is all that is required.

Materials: No textbook is required. Lecture Notes will be posted for students. Source texts will be given at some point in time for further reference.

You may also use a scientific calculator to aid in calculations, but this cannot be part of an electronic communication device during tests.

This course is supportive of the Student Learning Outcomes for the Bachelor of Science degree in Mathematics:

- 1) The student will be able to demonstrate content knowledge of basic mathematical principles.
- 2) The student will be proficient in logic, able to negate statements, provide counterexamples to false statements, and determine the validity of arguments.
- 3) The student will be able to communicate mathematical content clearly and with valid reasoning.

Grade: The **Homework Grade (15%)** will be based on daily homework (HW) assignments. Part of this grade will be based on in-class presentations or questions. There will be 3 tests each worth **25%** so the **Test Average** is worth **75%** altogether. Each test will count in the test average. The tests will be unit tests over the most recent unit of study though the third and final test may also cover material from the previous two units. Students who meet in

person will take their tests during the class time indicated. Students who meet remotely must have their 3 tests proctored in a professional setting or a testing center on the given test date or the next class day. The test dates are as follows:

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| Test 1 | Mon, July 20 |
| Test 2 | Wed, July 29 |
| Test 3 | Fri, August 7 |

Class **attendance** is mandatory and will be recorded.

Each student will work on, present, and hand in an **Individual Project Problem (IPP)** worth **10%** of the total final grade. This will be an individual problem selected by the student with guidance from the instructor who must give approval of this IPP. In terms of scope, the IPP will be more than a homework problem, but less than a formal paper over a topic of interest to the student. The deadline for approval of a student's IPP is Thursday, August 6. Final presentations will be Wed., August 12.

I give letter grades according to the traditional 90%-100% for an A; 80-89% for a B; 70-79% for a C; 60-69% for a D; and less than 60% for an F; with some exceptions. Students whose total average is between 50-59% with Test Average over 50% will often be rounded up to a D but only if the student has completed every major assignment (no exceptions) while doing their own best work. Students working similarly who end up with a final grade that is a borderline grade of 89%, 79%, or 69% will often be rounded up to the next grade-level as long as their test average is in line with this total average.

Pandemic Restrictions It is strongly encouraged that students get a vaccination and a booster for the Covid-19 Corona Virus and any other vaccine that is advised for you by medical professionals. Students are also encouraged to wear a proper face covering and follow social distancing guidelines based on your own personal decision as there have been recent increases in contagious diseases that includes Covid-19.

Late Work, Rescheduled Quizzes/Tests, Corrections It is important that students keep up with homework (HW) deadlines. Students will be able to correct HW for full credit up to the day of the test that covers that HW, so it is important to hand in HW by the deadline so that there is ample time for corrections of the HW prior to the next impending test. To take a test at a time other than the scheduled time, you must notify me of this **ON OR BEFORE THE SCHEDULED TEST DATES**, and this must satisfy one of two requirements: either (1) a written medical excuse signed by a medical professional for the day of the absence is supplied by the student, or (2) your excuse is for a university activity, in which case you must notify me of this authorized absence in writing with your name, the name of your organization and the date(s) of your absence, and your name must appear on a published explained absence list that I am provided (or this is verified by a faculty sponsor). Also, you and I must set up a time for you to make up the quiz or test within a reasonable time period (less than a week) before or after the time of the missed grade. Usually I will let you make up a test grade according to the above conditions if it is due to another one-time occurrence, such as the care of someone else in your family or a friend, or for a work-related excuse as long as you can document your absence and you let me know **BY THE DAY OF THE ABSENCE AT THE LATEST**. For the first two tests, students are allowed to correct tests for up to one-half points back, but this work must be handed in one

week after graded tests are returned if not earlier.

Attendance I will be taking attendance as university policy precludes you from missing 3 weeks or more (5 classes or more in this summer session) for anything other than authorized university activities. To excuse an absence for a university activity, in addition to letting me know of the absence by the day of the absence (as explained previously) you must also spend at least 90 minutes outside of class on this course with me or with a tutor, but they will need to sign a note that documents this made-up time. Also I will allow you to excuse a test day for a documented medical absence as long as you also make up the test with me, or with a proctor or in a testing center. If you have 5 classes or more of unexcused absences, I reserve the right to drop you from this class with a grade of 'F', which is university policy.

Good Advice Concentrate on learning the material of the course rather than worrying about your grade. Your time is best spent concentrating on the material to be learned in the impending assignments, asking questions, and devoting yourself to activities that will help you learn the material and do better in the course. I will worry about the details of your grade since you doing so does not help you earn a higher grade. But learning the material and doing well on the tests *will* help your grade. **Remember that math is not a spectator sport**, so the more problems you work yourself, and the more practice you get, the more confident you will be, and you will do better in this course. Working on the problems helps you to figure out what your specific questions are. Remember an individual homework or quiz grade may not count for a lot in your overall grade, but working and learning from the homework and quizzes is **essential** because this is where you learn the topics that will appear on the tests, which do count for a lot of your grade. The best lessons learned often come from correcting a quiz or homework problem in which you have made a mistake.

More Good Advice

Keep absences to a minimum. You never know when you might miss something you will find important either from the lecture or class discussion such as questions other students ask. Remember: **YOU ARE RESPONSIBLE FOR EVERYTHING THAT IS DISCUSSED DURING CLASS WHETHER YOU ARE PRESENT OR NOT.**

It's human nature to be controlled by our habits, so once you develop a daily habit for the summer session, it can be hard to break this habit. So be sure that you allow the necessary time for this course **FROM THE BEGINNING, ESPECIALLY** if you consider mathematics not to be your best subject. You should attend **EVERY** class of a college mathematics course. Not showing up to class or not doing the required work will not cause this class to magically go away. If you are not understanding the material and/or have fallen behind in your work, missing class will not help. **IF YOU FALL BEHIND, PLEASE DO NOT DROP THIS COURSE WITHOUT TALKING TO ME FIRST.** Making mistakes or falling behind is natural, so it is best to talk to me about this. If you do have to miss class, let me know before this absence, and plan to come and see me and make an appointment to discuss what was missed and pick up assignments or discuss what you are not understanding. It is essential to get your questions answered, which you are welcome to do in my office. However meeting in my office is not a substitute for attending class.

Ask questions no matter how easy or trivial they may seem. There is no such thing as a bad or silly question. Questions result when you are interested and have been thinking about areas, such as mathematics, in which you have some limitations in your educational background. Being in a college mathematics course means you will have questions both

obvious and more subtle. ASKING QUESTIONS IS A VERY IMPORTANT PART OF LEARNING.

Study and work problems regularly—every day or every other day. Work on assignments discussed in class as soon as you can after class while the methods discussed are still fresh in mind. You can't expect to succeed in a math course by waiting till the last minute to only study and cram prior to a test. If you promise yourself you will study for ½-hour, get into the work, forget the clock, then the next thing you know, you've studied and worked for one to two hours. Remember that

LEARNING FROM MISTAKES + PERSISTENCE = SUCCESS!

Classroom Conduct It is important to conduct yourself in a college classroom so that everyone can benefit from good communication between instructor and students. My goal is to create an environment in which everyone can do their best work, learn, and make the best grades possible.

I think you will find that I am a very friendly, sympathetic, and generous instructor as long as you are sincerely working to succeed in this course and certain guidelines for classroom behavior are followed to allow a sanctity of study for you and your fellow students. Habits such as holding conversations during lecture, or being engaged in activities not related to this course such as working on a different course or reading your cellphone will work against the goal of this course and cause you to be counted absent. Also engaging with electronic communication devices of any kind during class or coming into class more than 5 minutes late or leaving early before class is dismissed circumvent the goals of this course and cause you to lose credit. My sympathy and generosity will quickly evaporate if I find that you are working against the goals of the course or that you are simply trying to get a good grade without learning or without honestly doing the required work. I want you to have every opportunity to succeed in this course.

Please be aware of the rules for Academic Honesty that you will find in the Sul Ross Student Handbook. Use commonsense to think of anything else that will allow you to learn and do the best work that you can in this class, and for me to better help you do your best work. Remember that being registered for this course does not allow you to behave in any manner you wish during class. You must keep other people in mind. It is within university policy for me to send a student out of this class on a temporary or permanent basis if disruptions or interruptions like the types listed above persist.

Program Marketable Skills:

Marketable Skill (MS) 1: Students Demonstrate Logical and Analytical Skills.

MS 2: Students Demonstrate Problem-Solving Using Analytic and Algebraic Methods.

MS 3: Students Use Technology in Problem-Solving and Presentation.

MS 4: Students Use Communication and Pedagogical Skills.

ADA Statement

SRSU Accessibility Services. Sul Ross State University (SRSU) is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. Students seeking accessibility/accommodations services must contact Ronnie Harris, LPC, SRSU's Accessibility Services Director at 432-837-8203 or email ronnie.harris@sulross.edu. Our

office is located on the first floor of Ferguson Hall, room 112, and our mailing address is P.O. Box C122, Sul Ross State University, Alpine. Texas, 79832.

Academic Integrity

Students in this class are expected to demonstrate scholarly behavior and academic honesty in the use of intellectual property. Students should submit work that is their own and avoid the temptation to engage in behaviors that violate academic integrity, such as turning in work as original that was used in whole or part for another course and/or professor; turning in another person's work as one's own; copying from professional works or internet sites without citation; collaborating on a course assignment, examination, or quiz when collaboration is forbidden. Students should also avoid using open AI sources unless permission is expressly given for an assignment or course. Violations of academic integrity can result in failing assignments, failing a class, and/or more serious university consequences. These behaviors also erode the value of college degrees and higher education overall.

Required Student Responsibilities Statement

All full-time and part-time students are responsible for familiarizing themselves with the Student Handbook and the Undergraduate & Graduate Catalog and for abiding by the University rules and regulations. Additionally, students are responsible for checking their Sul Ross email as an official form of communication from the university. Every student is expected to obey all federal, state and local laws and is expected to familiarize themselves with the requirements of such laws.

SRSU Distance Education Statement

Students enrolled in distance education courses have equal access to the university's academic support services, such as library resources, online databases, and instructional technology support. For more information about accessing these resources, visit the SRSU website.

Students should correspond using Sul Ross email accounts and submit online assignments through Blackboard, which requires a secure login. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook. Students in web-based courses must maintain appropriate equipment and software, according to the needs and requirements of the course, as outlined on the SRSU website. Directions for filing a student complaint are located in the student handbook.

Counseling

Sul Ross has partnered with TimelyCare where all SR students will have access to nine free counseling sessions. You can learn more about this 24/7/365 support by visiting [Timelycare/SRSU](#). The SR Counseling and Accessibility Services office will continue to offer in-person counseling in Ferguson Hall room 112 (Alpine campus), and telehealth Zoom sessions for remote students and Sul Ross International students.

Classroom Climate of Respect

Importantly, this class will foster free expression, critical investigation, and the open discussion of ideas. This means that all of us must help create and sustain an atmosphere of tolerance, civility, and respect for the viewpoints of others. Similarly, we must all learn

how to probe, oppose and disagree without resorting to tactics of intimidation, harassment, or personal attack. No one is entitled to harass, belittle, or discriminate against another on the basis of race, religion, ethnicity, age, gender, national origin, or sexual preference. Still we will not be silenced by the difficulty of fruitfully discussing politically sensitive issues.

Supportive Statement

I aim to create a learning environment for my students that supports various perspectives and experiences. I understand that the recent pandemic, economic disparity, and health concerns, or even unexpected life events may impact the conditions necessary for you to succeed. My commitment is to be there for you and help you meet the learning objectives of this course. I do this to demonstrate my commitment to you and to the mission of Sul Ross State University to create a supportive environment and care for the whole student as part of the Sul Ross Familia. If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you.

Tentative Course Outline

Monday, July 6: First class day, discuss course, syllabus; Unit 1: Review of number theory, integers, divisibility, division algorithm, greatest common divisor

Tuesday, July 7: Euclidean Algorithm, Prime numbers, Modular Arithmetic

Wednesday, July 8: Modular arithmetic, solving congruences

Thursday, July 9: Basic properties of rings and fields, subrings, subfields, characteristic of rings

Friday, July 10: Subrings, subfields, characteristic of rings, review of Vector Spaces

Monday, July 13: Polynomial Rings: Arithmetic of Polynomial Rings, Division Algorithm, Greatest Common Divisor, Euclidean Algorithm for Polynomials

Tuesday, July 14: Polynomial Rings: Remainder Theorem, Factor Theorem, Rational Root Test

Wednesday, July 15: Unit 2: Ideals and Quotient Rings

Thursday, July 16: Field Extensions

Friday, July 17: Review for Test 1 that covers Unit 1

Monday, July 20: Test 1

Tuesday, July 21: Review of Groups, Subgroups

Wednesday, July 22: La Grange's Theorem, Primitive Elements of Finite Fields

Thursday, July 23: Algebraic Elements and Minimal Polynomials, More Reducibility of Polynomials

Friday, July 24: Unit 3: More Topics on Groups: The Sylow Theorems

Monday, July 27: More Topics on Groups: The Sylow Theorems

Tuesday, July 28: Review for Test 2 that covers Unit 2

Wednesday, July 29: Test 2

Thursday, July 30: Chinese Remainder Theorem, Euler Phi Function

Friday, July 31: Theorems of Fermat and Euler

Monday, August 3: Public-Key Cryptography, RSA encryption

Tuesday, August 4: Secant-Tangent Method for finding Rational Points on Algebraic Curves

Wednesday, August 5: Elliptic Curves and Elliptic Curve Cryptography

Thursday, August 6: Review for Test 3, Topic Approval Deadline for IPP

Friday, August 7: Test 3

Monday, August 10: Work on IPP, preliminary presentations

Tuesday, August 11: Work on IPP, preliminary presentations

Wednesday, August 12: Final presentations of IPP

Important University Dates

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| Mon, July 6 | First day of classes, first day of late registration and schedule changes Summer Session II |
| Wed, July 8 | Last day for late registration and schedule changes Summer II Payment Deadline for students 4 pm |
| Thu, July 9 | Last Day to Drop a Course Without Creating an Academic Record Summer Session II; 4th class day |
| Thu, July 23 | Mid-Semester, Summer Session II |
| Tue, July 28 | Deadline to Apply for Graduation Summer 2026 with late fee |
| Fri, July 31 | Last day to drop a class with a grade of "W" Summer II by 4 pm in University Registrar's Office |
| Wed, Aug 12 | Last Day of Classes, Final Exams of Full Summer Term, Summer II |