Welcome! This course is designed to assist students in learning about the tools used in research and how to apply them. You likely already know that SEM, XRD, and XRF are analytical instruments, but what are they each for? Why would you choose one technique over another? How will you prepare your samples? What kind of data will you get, and how will you analyze it? We’ll answer these questions, as well as questions related to the effective communication of data and results. The knowledge and skills you pick up here are useful in both academic and industry research, and beyond.

Course Description: Geoanalytical Methods (GEOL 5344) – Three semester hours (three lecture hours per week). The application of common geoanalytical methods to geologic materials (minerals, rocks, engineering samples), and approaches to accurate and effective data analysis and communication. Prerequisite: Graduate standing.

Course Modality: This is a full-semester, face-to-face course.

Lecture Periods: Mondays, 6:45-9:15 p.m., Miller Science Rooms 330, 332

Course Materials:
- No single textbook is suitable for the range of topics we will cover this semester. I will provide many excellent online resources and journal articles. Please see Brightspace for PDFs, links, and a list of suggested references.
- Access to a computer with internet. We will use online resources, Brightspace, Microsoft Office (you have access to Office 365 on campus), Adobe Acrobat Reader, etc.
- A notebook/folder/3-ring binder for organizing and accessing notes and handouts.
- You may need a pencil, eraser, calculator, straight edge, and colored pencils for course meetings and to complete assignments.
- A calendar/planner/app to track deadlines and class meetings.
**Program Learning Outcomes:**

PLO 1. Demonstrate knowledge of fundamental geoscience concepts. (*Concepts*)

PLO 2. Execute geoscience procedures and methods accurately, appropriately, and safely. (*Geoscience Skills*)

PLO 3. Demonstrate proficiency in interpretation and communication of geoscience information. (*Scientific Communication*)

PLO 4. Apply concepts, skills, and scientific communication to identify, analyze, and interpret geoscience phenomena. (*Research*)

**Student Learning Outcomes:** After successful completion of this course, students will be able to:

SLO 1. Identify the geoanalytical methods appropriate to address a particular research question. (PLO 1)

SLO 2. Explain how procedures related to sample preparation, standard analysis, and statistical reporting produce trustworthy geoanalytical results. (PLO 1)

SLO 3. Analyze geoanalytical data using software tools such as Excel and MATLAB. (PLO 1, 2)

SLO 4. Prepare figures that represent data in an accurate and effective manner. (PLO 1, 2)

SLO 5. Communicate the results and interpretations of a project using written, visual, and oral communication. (PLO 3, 4)

**Course Format:** Due to the applied nature of the course content and the lack of an appropriate textbook, this course is taught in the style of a “flipped” classroom. This means that you will view pre-recorded lectures and/or read reference materials prior to our regularly scheduled lecture. We will use lecture periods for learning activities, including discussion, laboratory tours, data analysis, and computer work. Coursework includes problem sets and a semester-long project on the analysis and interpretation of a geoanalytical dataset. Your progress during the semester will be assessed through regular quizzes, problem sets, the course project, and two exams (midterm and final).

**Graduate Course:** This course differs from the cross-listed undergraduate version of the course (GEOL 4344) as follows: 1) the problem sets and course project have greater scope and detail; 2) the exams require more detailed application of course concepts in essays; and 3) you will lead course discussions. There are also greater penalties for late work.

**Workload:** The unit of credit is the semester hour, defined as one class meeting per week (or its equivalent) for one 15-week semester. For each semester hour, you are expected to spend at least 2 hours per week in preparation and study. This 3-credit course meets for the equivalent of 3 lecture hours (150 minutes) per week. To complete this course successfully, you are expected to spend 9+ hours per week on 1) preparing for class by viewing pre-recorded lectures, reading handouts or reference materials, and completing assignments (problem sets, project); 2) attending lectures; 3) reviewing notes, lecture slides, readings, and assignments on a regular basis; and 4) studying for exams.
**Brightspace**: All course materials and useful resources are posted in the Brightspace (D2L) learning environment, which you can access through mySFA. It is your responsibility to check the site regularly for assignments and course announcements, and to complete assignments efficiently. Grades will be posted on Brightspace, but may differ slightly from my Excel grades, which are final. Please contact me directly at stevenslm@sfasu.edu; do not use D2L email. For technical assistance with Brightspace, please contact 936-468-1919, d2l@sfasu.edu, https://www.sfasu.edu/d2lsupport/students, or the Virtual Lab zoom hours (see purple box on the Brightspace home page).

**Class Meetings**: Complete assigned readings and view recordings prior to attending class in order to be prepared for quizzes and activities, and to make the best use of your time in lecture. It is your responsibility to take good notes during class meetings so that you have a record of concepts, chalkboard sketches, activities, and discussions not included in my image-heavy PowerPoint slides. *Hint*: If I am sketching, you should be sketching; taking photos instead of sketching is not acceptable. All slides and other lecture materials will be posted on Brightspace after class. You do not have my permission to record lectures, photograph slides, or share course materials in any format; please see me for exceptions.

**Review Questions & Vocabulary**: Each lecture PowerPoint ends with two review slides. The first contains vocabulary introduced or emphasized during the lecture; the second slide contains review questions designed to help you summarize, reinforce, and apply your new knowledge. I strongly recommend that you review these slides after each lecture, and again as you prepare for each exam. The most effective way to use review questions is to answer each question as thoroughly as possible, add sketches, discuss answers with classmates, and ask questions where your knowledge is limited.

**Quizzes**: I will give short quizzes randomly to assess comprehension of recent topics, pre-recorded lectures, and reading assignments. Quizzes will be brief (~10 minutes) and will typically be administered at the beginning of a class period. You may expect 5-10 quizzes per semester.

**Problem Sets**: Problem sets are assigned to provide practical experience with the geoanalytical methods discussed in class (see syllabus schedule). Additional problem sets may be assigned as warranted. You are expected to work independently toward the completion of problem sets, unless otherwise instructed.

**Course Project**: You will complete a research project in which you will analyze and interpret a geoanalytical dataset, and produce accompanying data tables and figures. Due to the costly and time-consuming nature of sample preparation and analysis, you likely will not have the option to start from scratch on original research. You will complete data analysis for multiple methods (e.g., microscopy, imaging, spectroscopy, etc.) using software discussed in class (e.g., Excel, MATLAB), and you will generate your own figures. Whenever possible, you will use your geoanalytical dataset to complete problem set assignments. Your final project will take the form of a 20-minute PowerPoint presentation.
Exams: The midterm and final exams will test course concepts. The question formats will include problems and short essays, as well as short-format questions (e.g., multiple choice). I will test both your general knowledge and your ability to apply course knowledge through exam questions. The final exam is not cumulative. You will need a pencil, eraser, straight edge, and calculator (if indicated; not your phone) for exams. The use of any other materials or devices during exams is not permitted.

Course Schedule: The course schedule at the end of the syllabus outlines the schedule of meetings, lecture topics, and course activities, as well as the due dates for all assignments. Assignments (including viewing pre-recorded lectures) are due at the beginning of class on the day listed. I reserve the right to modify the schedule as needed, and I will notify you accordingly.

Attendance: You are expected to attend all lectures in their entirety.

If You Have Been Absent: I do not need/want/expect an explanation, a doctor’s note, or any other evidence. I just want you to communicate with me to get caught up! You are responsible for making up missed work. Here’s how:

1. The syllabus will tell you what you missed. Check Brightspace for new course materials and announcements.
2. Contact a classmate to get a copy of any notes.
3. Contact me to arrange new due dates or for assistance with missed material. You do not need to contact me about an absence unless you need new deadlines or assistance.
4. Attend student hours or make an appointment with me or your TA for additional assistance.

Late Work: If you have an upcoming absence or are having trouble completing an assignment on time, please contact me by the business day before the due date about alternative arrangements. Otherwise, a 10% per school day penalty (to a maximum loss of 30%) will apply to all assignments. No assignment will be accepted for credit after the assignment has been graded and returned – keep on top of your work!

Final Grades: Your final grade will be determined by summing the weighted averages of your grades in each of the categories below. Letter grades will be assigned as follows: A (90.0–100), B (80.0–89.9), C (70.0–79.9), D (60.0–69.9), F (< 60.0). There will be no extra credit assignments – focus your attention on the tasks at hand.

- Quizzes 10%
- Problem Sets 30%
- Geoanalytical Project 40%
- Midterm & Final Exams 20%

Extra Credit: There are no extra credit assignments – focus your attention on the tasks at hand.
Success! Your academic achievement naturally depends on your level of involvement in this course. You improve your chances of success if you: complete all readings and assignments, attend all course meetings, keep course materials organized, participate in activities and discussions, take advantage of student hours, review regularly, form study groups, make use of available resources, ask questions, plan your time, sleep regularly, eat well, get outdoors, etc. I am committed to helping you be successful in all ways. My office is open to you and I hope you will find it a safe space. Do not hesitate to ask for help!

Student Hours: Student hours (aka office hours) are the times when I guarantee my availability to you with no appointment necessary, so please drop in. Student hours are a good time to discuss course topics, ask questions, discuss your course progress, talk about ways to improve your understanding, ask questions about your future (other courses, research, grad school, careers, etc.), or just chat. My student hours for this semester are listed at the top of this syllabus. Student hours will be held in my office, but feel free to request a Zoom meeting instead. Student hours are open to all students, no appointment necessary, so please drop in. To plan longer meetings or for meetings on other days and times, please email me.

Communication: Get in touch whenever you have questions or concerns. You are not pestering me. Not only is it my job to help you, but I really like doing it! Email me at stevenslm@sfasu.edu (no D2L email), drop in during student hours or whenever my door is open, or schedule a meeting with me. I typically respond to emails quickly during the workday, but responses will be slow during evenings and weekends; you may not get a response until the next business day, so plan accordingly. I don’t check my office voicemail when I’m off campus. When I have important information to communicate to you, I will post a news item on Brightspace; I will contact you directly through your SFA email when privacy is required. It is your responsibility to check both Brightspace and your Jacks email every day.

Classroom Courtesy: Please be considerate of your classmates and of me. Refrain from distracting behaviors, and keep electronic devices silent. Use of electronic devices for purposes other than participating in class (e.g., note-taking), such as listening to music or studying for other courses, is distracting, and therefore not acceptable in the classroom. You may not photograph or record lectures without my permission – you will find all resources on Brightspace/D2L.

Students with Disabilities: To obtain disability related accommodations, alternate formats, and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Room 325, Human Services Building, 936-468-3004/1004 (TDD) as early as possible in the semester. Once verified, ODS will notify me and outline the accommodations and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices. Please get in touch with me at the beginning of the semester to discuss arrangements for accommodations.

Color Vision Deficiency: Color vision deficiency (CVD, aka color blindness) poses additional challenges to geoscientists working with samples and thin sections. If you experience CVD, please notify me so that I can better assist you.
**Getting Through the Semester**: You are human. It is challenging to do your best work if basic needs like safe shelter, sleep, and nutrition are not met, not to mention all of the other stressors in the world. You are always welcome to talk to me, and I aim to make my office a safe space, but you do not owe me any personal information about your health or anything else. If you’re having trouble, I will not judge or think less of you, and I hope you’ll extend the same grace to each other and to me. If you need help accessing sufficient food, a safe and stable place to live, mental or physical health resources, or other basic needs, please just ask. If I can’t help you I’ll direct you to the person who can. Please also refer to the list of resources on Brightspace. There is a shelf of snacks and quick lunches in my office – you are welcome to take what you need, you don’t need to ask. I am here to help you.

**Student Wellness & Well-Being**: SFASU values students’ overall well-being, mental health, and the roles both play in academic and overall student success. Students may experience stressors that can impact both their academic experience and their personal well-being. These may include academic pressure, challenges associated with relationships, emotional well-being, alcohol and other drugs, identities, finances, etc. If you are experiencing concerns and seeking help, SFA provides a variety of resources to support students’ mental health and wellness. Many of these resources are free, and all of them are confidential.

**On Campus**:
- **The Dean of Students Office**
  - [www.sfasu.edu/deanofstudents](http://www.sfasu.edu/deanofstudents)
  - 3rd floor lobby, Rusk Building
  - 936-468-7249
dos@sfasu.edu
- **The Health and Wellness Hub. Health and Counseling Services, Student Outreach and Support, Food Pantry, Wellness Coaching, Alcohol and other Drug Education...**
  - [www.sfasu.edu/thehub](http://www.sfasu.edu/thehub)
  - Corner of E. College and Raguet St.
  - 936-468-4008
  - thehub@sfasu.edu
- **SFASU Human Services Counseling Clinic**
  - [www.sfasu.edu/humanservices/139.asp](http://www.sfasu.edu/humanservices/139.asp)
  - Human Services Room 202
  - 936-468-1041

**Crisis Resources**:
- Burke 24-hour crisis line: 1-800-392-8343
- National Suicide Crisis Prevention: 988
- Suicide Prevention Lifeline: 1-800-273-TALK (8255)
- Crisis Text Line: Text HOME to 741741

**COVID-19**: While masks are no longer required, your responsible and considerate behavior regarding communicable illnesses is appreciated. Continue to wash your hands well, use sanitizer, wear a mask, or keep your distance when appropriate. If you are feeling unwell, test positive, or were exposed to COVID-19/flu/RSV/strep/etc., please do not attend any F2F classes or events.

**Academic Integrity**: Abiding by university policy on academic integrity is the responsibility of all university faculty and students. **You are encouraged to ask questions about completing your coursework with academic integrity.** Articles IV, VI, and VII of the new Code of Student Conduct and Academic Integrity outline the violations and procedures concerning academic conduct, including cheating, plagiarism, collusion, and misrepresentation. **Cheating** includes, but is not limited to: (1) Copying from the test paper (or other assignment) of another student, (2) Possession and/or use during a test of materials that are not authorized by the person giving the test, (3) Using, obtaining, or attempting to obtain by any means the whole or any part of a non-administered test, test key,
homework solution, or computer program, or using a test that has been administered in prior classes or semesters without permission of the Faculty member, (4) Substituting for another person, or permitting another person to substitute for one’s self, to take a test, (5) Falsifying research data, laboratory reports, and/or other records or academic work offered for credit, (6) Using any sort of unauthorized resources or technology in completion of educational activities. **Plagiarism** is the appropriation of material that is attributable in whole or in part to another source or the use of one’s own previous work in another context without citing that it was used previously, without any indication of the original source, including words, ideas, illustrations, structure, computer code, and other expression or media, and presenting that material as one’s own academic work being offered for credit or in conjunction with a program course or degree requirements. **Collusion** is the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any provision of the rules on academic dishonesty, including disclosing and/or distributing the contents of an exam. **Misrepresentation** is providing false grades or résumés; providing false or misleading information in an effort to receive a postponement or an extension on a test, quiz, or other assignment for the purpose of obtaining an academic or financial benefit for oneself or another individual or to injure another student academically or financially.

**My Expectations for Academic Integrity:** As scientists and as humans, our reputations are directly linked to our honesty, trustworthiness, and personal ethics; otherwise, what’s the point? What does academic integrity look like in our classroom?

- The university and course policies in this syllabus outline basic expectations for all students.
- You will complete assignments according to the instructions given regarding permitted tools and resources, collaboration, time limits, etc.
- Unless explicitly instructed otherwise, only your course textbook, lecture slides, course handouts, and your own lecture notes are acceptable resources.
- If you are asked to work with classmates, it is meant to be a collaboration, where all partners contribute equally. Collaboration allows for discussion, but be careful not to cross the boundary between collaboration and groupthink. Your submitted work will be entirely your own words and thoughts. Always note your collaborator(s) on your work.
- Sharing your work with another student, whether or not it is used word-for-word, is cheating.
- Websites or other resources that answer students’ questions or gather and disperse course materials are never acceptable. This includes AI tools.
- We often run into trouble when we’re feeling pressured for time. Plan plenty of time before due dates. If you start feeling panicked, please come and talk with me. Always **ask for clarification or assistance whenever it is needed.**
- Your classmates’ grades are not your business. All that matters is how you learn from your own mistakes, and how you improve.
- For assignments, your first offense will result in a conversation. All other offenses will result in the initiation of an Academic Integrity Case. Recommended sanctions will include an assignment or exam grade of 0, or a 0 grade for the course.
**Withheld Grades:** At my discretion and with the approval of the chair of the department, a grade of WH will be assigned only if you cannot complete the course work because of unavoidable circumstances. You must complete the work by a mutually agreed upon deadline, which is not to exceed one calendar year from the end of the semester in which you receive a WH, or the grade automatically becomes an F, except as allowed through policy [i.e., Military Service Activation (6.14)]. If you register for the same course in future semesters, the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average. Policy 5.5.
## Course Schedule – GEOL 5344 – Geoanalytical Methods – Spring 2024

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>In Class</th>
<th>Assignments Due</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>M Jan. 15</td>
<td>Course Introduction Data, Error &amp; Uncertainty</td>
<td></td>
<td>Read: Syllabus Watch: Error &amp; Uncertainty</td>
</tr>
<tr>
<td>2</td>
<td>M Jan. 22</td>
<td>Data</td>
<td>Course Introduction Data, Error &amp; Uncertainty</td>
<td>Watch: Data Quality Watch: Standard Analysis</td>
</tr>
<tr>
<td>3</td>
<td>M Jan. 29</td>
<td>Quantitative Data &amp; Standards Data Quality</td>
<td></td>
<td>Watch: Data Quality Watch: Standard Analysis</td>
</tr>
<tr>
<td>4</td>
<td>M Feb. 5</td>
<td>X-Ray Fluorescence (XRF)</td>
<td>X-Ray Fluorescence (XRF)</td>
<td>Watch: X-Ray Fluorescence Watch: XRF Sample Prep &amp; Analysis</td>
</tr>
<tr>
<td>5</td>
<td>M Feb. 12</td>
<td>Excel &amp; MATLAB</td>
<td>Excel &amp; MATLAB</td>
<td>Watch: Excel and Charts Watch: Charts Due: Problem Set 1 (XRF)</td>
</tr>
<tr>
<td>6</td>
<td>M Feb. 19</td>
<td>Data Analysis &amp; Communication</td>
<td>Data Analysis &amp; Communication</td>
<td>Watch: Intro to MATLAB Due: Problem Set 1 (XRF)</td>
</tr>
<tr>
<td>7</td>
<td>M Feb. 26</td>
<td>Generating Figures</td>
<td>Generating Figures</td>
<td>Watch: Inkscape Watch: Figure Generation Due: Problem Set 2 (Graphs)</td>
</tr>
<tr>
<td>8</td>
<td>M Mar.  4</td>
<td></td>
<td></td>
<td>Watch: Figures &amp; Captions</td>
</tr>
<tr>
<td>9</td>
<td>M Mar. 11</td>
<td>No Classes – Spring Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>M Mar. 18</td>
<td>Microscopy</td>
<td>MIDTERM EXAM Polarized Light Microscopy</td>
<td>Watch: Polarized Light Microscopy</td>
</tr>
<tr>
<td>15</td>
<td>M Apr. 22</td>
<td>Course Project</td>
<td>Course Project</td>
<td>PROJECT PRESENTATIONS Due: Course Project</td>
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<td>16</td>
<td>M Apr. 29</td>
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<td></td>
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<tr>
<td>17</td>
<td>M May 6</td>
<td>Final</td>
<td>Final Exam</td>
<td></td>
</tr>
</tbody>
</table>

*This course is taught as a “flipped” classroom. Pre-recorded lectures and/or reading materials will be available online at least one week prior to the regularly scheduled class. It is expected that you will view/read these materials prior to coming to each class so that we can spend our class time on learning activities, including comprehension quizzes, discussion, data analysis, and programming. This schedule is subject to change.*