**GLY 320L**

**Lab techniques in Geology and Environmental Science**

**Credit hours:** 2 units

**Pre-requisites:** Science majors; consent of instructor

**Instructor:** Aley El-Din El-Shazly **e-mail**: elshazly@marshall.edu

**Office:** 131 Science Building **Tel**: 304 – 696 – 6756

**Lectures/ Labs:** W: 1:00 – 3:50 p.m., Rooms 125/ 128.

**Office hours:** **M-F:noon – 1; TR 11 – 1:00, or by appointment**. You could always e-mail me, and I will get back to you as soon as possible. I also have an open door policy, if you cannot make it to my office hours, and I'm in my office between 9:00 and 3:00 p.m., it doesn't hurt to check with me; ... if I'm free, I'll be more than happy to help you. Please note that you will need to work in the lab outside the class hours, but your work MUST be supervised by me, so you have to coordinate carefully with me when you wish to complete your assignments.

**Objectives and Assessment**:

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| **Course Objective** | **Student activity** | **Assessment Tool** |
| learn how to collect and prepare samples for various types of analyses (chemical, petrological, and mineralogical) | Reading, Class discussion, Lab work | Instructor observation |
| learn how to use the equipment currently available in the Geology Department and the College of Science to obtain precise and meaningful data | Reading, Class discussion, Lab work | Lab reports |
| understand the capabilities of each piece of instrumentation and its limitations | Class interaction, readings  | Final exam, Lab reports |
| understand the basic theory behind the operation of each instrument  | Reading, Class discussion, Lab work | Lab reports, Final exam |
| learn how to process and sometimes interpret the data to help solve a problem of some geologic/ environmental relevance; learn how to manipulate large data sets | Homeworks, class discussions, readings, demonstrations | Homeworks, Lab reports |
| learn the basic principles of statistical analysis of your data | Homeworks, class discussions, readings  | Final exam, Lab reports |
| learn how to write professional technical reports | Homeworks, class discussions, Lab reports | Lab reports, projects. |

Tools necessary for success in this class include demonstrations, class discussions, readings, and team work. All of the above objectives will be assessed through graded weekly reports. The final exam will be used mainly to assess objectives 3 & 4 (along with a few other objectives as well).

**Textbooks:**

None. In this class, we will rely on handouts, copies of standard operating procedures for the various pieces of instrumentation (already available in the labs), as well as copies of pertinent chapters from various textbooks dealing with geochemical analysis and operating manuals for the equipment at hand.

**Attendance/ Class behavior:** Attendance of labs is expected. Once in class, mature behavior is expected. Cell phones must be turned off, and their use is prohibited in class, tests, and exams. Disruption of class/ lab activities will not be tolerated.

**Grade assignment:**

Weekly lab reports 70%

Final Exam 30%

A total of 10 lab reports and exercises will be graded, and will serve as the main basis for grade assignment (70% of grade). Each assignment is due a week from the date it is assigned. Late submission of the assignment will carry a penalty of 5%. The grade for each lab will be based on your ability to follow lab procedures properly, your proficiency in carrying out the lab assignments, observing the safety protocols, and your ability to present your results in an organized fashion. The final exam will cover the theoretical basis of operation of some of the equipment at hand ± some problems (total 30%). Please note that attendance is mandatory in this class. There will be no chance of “making up” for missed labs or assignments.

An entirely different grading method will be applied for those students with their own research projects. Grade assignment for those students will be agreed upon based on their research project, which has to be approved by the instructor. A significant portion of the grade in this case will be based on a research paper (minimum 25%), and possibly a public presentation at the end of the semester (5%). Weekly labs will continue to be worth 65–70% of the grade.

**Grading scheme:** A: > 90%; B: 80 – 89.9%; C: 70 – 79.9%; D: 60 – 69.9%; F: < 60%.

**Computer Requirements**: All students should have basic knowledge of MS-Excel for basic data manipulation, calculations and plotting. Working knowledge of DOS will also be helpful. If you do not have your own laptop or are unable to bring it to some classes, please let me know ASAP.

**University Policies/ Resources:** By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to [www.marshall.edu/academic-affairs](http://www.marshall.edu/academic-affairs) and clicking on “Marshall University Policies.” Or, you can access the policies directly by going to <http://www.marshall.edu/academic-affairs/?page_id=802>

Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment.

**Policy for Students with Disabilities:** For University policies and the procedures for obtaining services, please go to [MU Academic Affairs: University Policies](http://www.marshall.edu/academic-affairs/policies/) and read the section, **Students with Disabilities**. (URL: <http://www.marshall.edu/academic-affairs/policies/> )

**Academic Integrity**: Academic dishonesty as defined in the undergraduate catalogue on page 101 will not be tolerated. Violations of the honor code may result in the assignment of an “F grade” for the class, and further disciplinary action as defined in the catalogue.

**Final Thoughts**: Please keep in mind that I am **committed** to making this course a positive experience for everyone, so don’t hesitate to ask me questions, or approach me with problems that you are facing in this class. Feel free to stop by my office to discuss your progress in class or go over problems with your research project.

**References:**

Goldstein, Joseph I.; Newbury, Dale E.; Echlin, Patrick; Joy, David C.; Fiori, Charles; Lifshin, Eric, 1981. Scanning Electron Microscopy and X-Ray Microanalysis: A Test for Biologists, materials Scientists, and Geologists. New York: Plenum Press.

Moore, D. M., and Reynolds, R. C., 1997. X-Ray Diffraction and the Identification and Analysis of Clay Minerals, Oxford University Press.

Miscellaneous, 1991. Analytical Methods for the Liberty Spectrometer System. Varian Australia.

Reed, S.J.B., 1996. Electron Microprobe Analysis and Scanning Electron Microscopy in Geology. Cambridge University Press,Great Britain .

Rothery, E., 1988. Analytical Methods for graphite tube atomizers. Varian Australia.

Wainerdi, R. E., Uken, E. A., 1971. Modern Methods of Geochemical Analysis. Plenum Press, New York, London.

**Syllabus & Tentative Lab Schedule**

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| **Lab** | **Week** | **Topic** | **Equipment** |
|  | 1Aug 22 | Basic principles and objectives; safety measures; grand tour of the labs |  |
| 1 | 1 & 2Aug. 29 | Sample crushing, sieving and separation of minerals | Frantz Isodynamic separator |
| 2 | 3, 4Sept 5, 12 | Principles of X-ray DiffractometryBasic statistics: Experimental designs; Normal distributions; Accuracy, Precision.  | XRD |
| 3 | 5Sept 19 | Analysis of aqueous solutions I: Mixing & Dilution; Preparation of standards | ICP-AES |
| 4 | 6Sept 27 | Analysis of aqueous solutions II: Standard Addition techniques | ICP-AES |
| 5 | 7Oct 3 | Analysis of aqueous solutions III: Trace amountsBasic statistics: standard deviations, significance, detection limits, factor analysis. | GF-AAS |
| 6 | 8Oct 10 | Chemistry of Natural waters: Cations & anions | Collection; filtration; acidification; pH meter; conductivity; spectrophotometers; Hach digital titrator and kits |
| 7 | 9Oct 17 | Bulk chemical analysis of rock samples: major elements | Single solution method; muffle furnace; ICP-AES |
| 8 | 10Oct 24 | Bulk chemical analysis of rock samples: trace elements  | Acid digestion method; ICP-AES |
|  | 11Oct 31 | Continue work on ICP reports/ data interpretation | Data interpretation: GCDkit |
| 9 | 12Nov 7 | Analysis of minerals in thin section: Principles & imaging | SEM |
| 9 | 13Nov 14 | Analysis of minerals in thin section: quantitative analysis | SEM; data processing and interpretation |
|  | 14Nov. 28 | Microthermometry of fluid inclusions | Linkam Stage |

**Final Exam:** Dec. 5 1:00 – 3:00 p.m. (or TBA).

**N.B.** This syllabus, grade assignment, and timetable are tentative, and can be changed according to status of equipment, and student projects.