GEOL 471 - SYLLABUS
Geochemical Methods of Analysis

INSTRUCTOR: William F. McDonough (www.geol.umd.edu/~mcdonoug)
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OFFICE: 0229 Chemistry building OFFICE HOURS: e-mail for appt time
COURSE HOURS AND LOCATION: M 1:30 – 2: 50 PM PLS 1115
W 1:30 – 2: 50 PM PLS 1115
REQUIRED TEXTBOOK: There is no required textbook for this course. I will distribute handouts and/or pdf files for readings throughout the semester.
RECOMMENDED TEXTBOOK: You would be well served to own one of these reference books.

(1) *The Essential Guide to Analytical Chemistry* (1997) by G. Schwedt, 2nd edition, John Wiley & Sons, 248 pp. (cost $63) ISBN#: 0 471 97412 9 (Great book, good referece.)

(2) *Modern Analytical Geochemistry* (1997) Robin Gill (Ed), Longman (Pearson Education Limited), 329 pp. (cost $33) ISBN#: 0 582 09944 7. (Out of Print, very good set of broad descriptions of modern techniques. Variable writing quality between chapters.)

(3) *Principles of Instrumental Analysis* (1998) D.A. Skoog, F.J. Holler, and T.A. Nieman, 5th edition, Saunders College Publishing, 832 pp. (cost ~$130, new, but there are plenty of used copies out there) ISBN#: 0 03 002078 6 (Bible in many folks view of instruments, organic and inorganic.)

(4) *A Handbook of Silicate Rock Analysis* (1987) P.J. Potts Blackie. (cost ~$110, new, but there are plenty of used copies out there) ISBN#: 0412008815 (This book has a comprehensive and detailed coverage of a wide range of techniques, which is approachable at both elementary and advanced levels).

-- Prof. Neil Blough uses book #3 for his Chem 425: Instrumental Methods of Analysis (it focuses on instrumentation in organic chemistry; it is a complementary course to this one).

COURSE GOALS: This course is designed to introduce the theory, applications, and operation of modern instrumental methods for chemical analysis in environmental, earth and materials science. Students will be introduced to a wide spectrum of instrumental techniques and will gain an understanding of the analytical approach to problem solving.
Prerequisites: CHEM 113, or its equivalent

COURSE GRADING: 60% exams

20% assignments

20% presentations

COURSE REQUIREMENTS: There will be several assignments (e.g., lab problems, small homework exercise, etc). The homework exercises will be e-mailed to me the day before the next class (by 12 PM midnight). The laboratory assignments will include a brief report of results and analytical technique (≤5 pages, no longer). There will be 3 exams. Need for make-up exams will be dealt with on a case-by-case basis. Students will be expected to make at least 2 in-class presentations: one on a technique (30 minutes followed by questions) and one on the analyses of your samples (10 minutes, followed by questions).

LAB: We will visit and use the mass spectrometry laboratories in the Department of Geology and the electron microprobe laboratory in the material science center. Students will be involved in the analyses of samples; this work will be done in combination with laboratory staff.

GEOL 671 (Geochemical Methods of Analysis) : SCHEDULE & WEEKLY TOPICS DATE	**TOPIC**
W 25 Jan	Goals of chemical/isotopic analyses
M 30 Jan	Problem - Analyses strategy
W 1 Feb	Fundamental Steps (preparation)
M 6 Feb	Data & Error Analysis
W 8 Feb	Chromatography - ***Water analyses***
M 13 Feb	Sample decomposition – Chromatography
W 15 Feb	Electronics
M 20 Feb	**IN CLASS EXAM**
W 22 Feb	Instrumentation: MS, INAA, Atomic Spectroscopy overview
M 27 Feb	**Student Presentations**
W 1 Mar	INAA
M 6 Mar	AAS/AES/ICP-AES
W 8 Mar	XRF - XRD
M 13 Mar	EPMA – Principles, SEM & BSE
W 15 Mar	EPMA – XRF (WDS & EDS)
M 20 Mar	SPRING BREAK
W 22 Mar	SPRING BREAK
M 27 Mar	**IN CLASS EXAM**
W 29 Mar	Intro & First Principles ion sources, vacuums
M 3 Apr	First Principles ion optics systems
W 5 Apr	First Principles ion collection systems
M 10 Apr	ICP-MS

W 12 Apr	Laser ablation
M 17 Apr	**Mass Spec Lab day**
W 19 Apr	**Mass Spec Lab day**
M 24 Apr	TIMS
W 26 Apr	Gas Source MS
M 1 May	SIMS
W 3 May	Student Presentations (30 minute presentations)
M 8 May	Student Presentations
W 10 May	Other methods
M 15 May	**Final Exam**