Course Approval Form

For approval of new courses and deletions or modifications to an existing course.

registrar.gmu.edu/facultystaff/curriculum

Action Requested:

- [X] Create new course
- [ ] Inactivate existing course
- [ ] Modify existing course (check all that apply)
  - [ ] Title
  - [ ] Credits
  - [ ] Repeat Status
  - [ ] Grade Type
  - [ ] Prereq/coreq
  - [ ] Schedule Type
  - [ ] Restrictions
  - [ ] Other:

Course Level:

- [ ] Undergraduate
- [X] Graduate

College/School: College of Science
Department: Chemistry and Biochemistry
Submitted by: Greg Foster
Ext: 3-1081
Email: gfoster@gmu.edu

Subject Code: CHEM
Number: 627
(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term:

- [X] Fall
- [ ] Spring
- [ ] Summer

Year 2013

Title:
Current
Banner (30 characters max including spaces): Aquatic Environ Chemistry
New: Aquatic Environmental Chemistry

Credits: (check one)

- [X] Fixed: 3 or
- [ ] Variable: to

Repeat Status: (check one)

- [X] Not Repeatable (NR)
- [ ] Repeatable within degree (RD)
- [ ] Repeatable within term (RT)

Maximum credits allowed:

Grade Mode: (check one)

- [X] Regular (A, B, C, etc.)
- [ ] Satisfactory/No Credit
- [ ] Special (A, B C, etc. +IP)

Schedule Type: (check one) LEC can include LAB or RCT

- [X] Lecture (LEC)
- [ ] Lab (LAB)
- [ ] Recitation (RCT)
- [ ] Internship (INT)
- [ ] Independent Study (IND)
- [ ] Seminar (SEM)
- [ ] Studio (STU)

Prerequisite(s):
CHEM 321 or GEOL 302 or equivalent courses or permission of the instructor

Corequisite(s):

Instructional Mode:

- [X] 100% face-to-face
- [ ] Hybrid: ≤ 50% electronically delivered
- [ ] 100% electronically delivered

Restrictions Enforced by System: Major, College, Degree, Program, etc. Include Code.

Are there equivalent course(s)?

- [ ] Yes
- [X] No

If yes, please list

Catalog Copy for NEW Courses Only (Consult University Catalog for models)

Description (No more than 60 words, use verb phrases and present tense)

Thermodynamic and kinetic processes regulating the chemistry of surface and groundwater in natural and polluted environments with particular emphasis in explaining the aqueous concentrations of chemical species and controlling geochemical factors in the hydrosphere. Structure, sources and transformations of organic matter in the aquatic environment and interactions with aqueous solutes will be covered as related to contemporary issues in water quality. Students will be assigned papers from the primary literature and be required to answer questions from these papers on exams.

Notes (List additional information for the course)

Indicate number of contact hours: Hours of Lecture or Seminar per week: 3 Hours of Lab or Studio: 0

When Offered: (check all that apply)

- [X] Fall
- [ ] Summer
- [ ] Spring

Approval Signatures

Department Approval Date

College/School Approval Date

If this course includes subject matter currently dealt with by any other units, the originating department must circulate this proposal for review by those units and obtain the necessary signatures prior to submission. Failure to do so will delay action on this proposal.

Unit Name	Unit Approval Name	Unit Approver's Signature	Date

For Graduate Courses Only

Graduate Council Member

Provost Office

Graduate Council Approval Date

For Registrar Office's Use Only: Banner_____Catalog_____

revised 11/8/11

Course Proposal Submitted to the Curriculum Committee of the College of Science

1. COURSE NUMBER AND TITLE: CHEM 627 Aquatic Environmental Chemistry

Course Prerequisites: CHEM 321 or GEOL 302 or equivalent courses or permission of the instructor

Catalog Description: Thermodynamic and kinetic processes regulating the chemistry of surface and groundwater in natural and polluted environments with particular emphasis in explaining the aqueous concentrations of chemical species and controlling geochemical factors in the hydrosphere. Structure, sources and transformations of organic matter in the aquatic environment and interactions with aqueous solutes will be covered as related to contemporary issues in water quality. Students will be assigned papers from the primary literature and be required to answer questions from these papers on exams.

2. COURSE JUSTIFICATION:

Course Objectives: The course serves as an introduction to freshwater chemistry, providing theory and applications in chemical equilibrium problem solving for primarily inorganic chemical species in water.

Course Necessity: The course is intended primarily for chemistry and environmental science & policy degree majors that work or conduct research in freshwater aquatic environments, such as lakes, streams and rivers.

Course Relationship to Existing Programs: CHEM 627 will partially satisfy course requirements for the Analytical and Environmental research emphasis area in the Chemistry and Biochemistry PhD degree, and will serve as an aquatic science elective in the MS in Environmental Science and Policy, Aquatic Ecology Concentration.

Course Relationship to Existing Courses: CHEM 627 is designed to be complementary to CHEM 651, a core course in the MS in Chemistry and a research specialization course in the PhD in Chemistry and Biochemistry that focuses on the sources, fate and transport of organic chemical species in the geosphere.

3. APPROVAL HISTORY: Approved by the Department of Chemistry and Biochemistry on Dec 14, 2012.

4. SCHEDULING AND PROPOSED INSTRUCTORS:

Semester of Initial Offering: Fall 2014

Proposed Instructors: Greg Foster

5. TENTATIVE SYLLABUS: attached

Chemistry 627
Fall 2014

Aquatic Environmental Chemistry

Prerequisites: Introductory course in inorganic chemistry or permission of the instructor
Instructor: Gregory D. Foster (gfoster@gmu.edu, mason.gmu.edu/~gfoster)
Office Hours:
Textbook: Langmuir, Donald (1997) Aqueous Environmental Geochemistry, Prentice Hall
Course Description: Thermodynamic and kinetic processes regulating the chemistry of surface and groundwater in natural and polluted environments with particular emphasis in explaining the aqueous concentrations of chemical species and controlling geochemical factors in the hydrosphere.
Course Objectives: The purpose of this course is to provide an understanding of the fundamental geochemical processes that govern the chemical composition of natural waters and the distribution and reactions of chemical species in natural waters.

Lecture Schedule:

Dates	Chapter	Text Reading	Topic
Week 1	1	1.1-1.4.3, 1.5, 1.6.1-1.6.2 2.1-2.4, 2.6	Introduction and Primer on Thermodynamics and Kinetics
Week 2	5	5.1-5.7, 5.10.1-5.10.4	Acids and Bases, Acidity and Alkalinity
Weeks 3 & 4	3	3.1-3.6. 3.8	Complexation Reactions
Week 5	4	4.1-4.4	Activity Coefficients of Dissolved Species
Week 6		**Exam I**	(Chapters 1, 5, 3 & 4)
Week 7	6	6.1-6.4	Carbonate Chemistry
Weeks 8 & 9	7	7.1-7.7	Chemical Weathering & Oxyhydroxide Solubility
Week 10	9	9.1, 9.2, 9.5, 9.6	Clay Minerals
Weeks 11-13	10	10.1-10.4.4	Sorption and Desorption
Week 14		**Exam II**	(Chapters 6, 7 & 9)
Week 15	11	11.1 & 11.2	Redox Chemistry
		Final Exam	Comprehensive

Presentations: Each student is required to give two 15 min talks to the class on a specific research topic related to the material covered in class. The talks will be based on a literature search involving journal papers.
Homework: Homework will be assigned and graded. Some homework will be assigned that requires the use of the geochemistry program Visual MINTEQ. A download copy (free) is available at http://www.lwr.kth.se/English/OurSoftware/vminteq/ (this program is designed to operate in Windows).
Exams: Two (in-class) mid-term exams and a final exam will be administered.
Grading: Mid-term exams (30%), Final exam (25%), Homework (25%), Research Presentations (20%).
Most Relevant Journals: Applied Geochemistry, Aquatic Geochemistry, Chemical Geology and Geochim et Cosmochim Acta
Reference Books:
The Geochemisry of Natural Waters (JI Drever), Prentice Hall
Aquatic Chemistry Concepts (J Pankow), Lewis
Aquatic Chemistry (W Stumm and JJ Morgan), Wiley-Interscience
Principles and Applications of Aquatic Chemistry (F Morel and JG Hering), John Wiley & Sons