



LSC Use Only:  
Number: \_\_\_\_\_  
Submission Date: \_\_\_\_\_  
Action Date: \_\_\_\_\_

UWUCC Use Only:  
Number: 00-38d  
Submission Date: \_\_\_\_\_  
Action Date: UWUCC App 12/19/00  
Senate App 1/30/01

**CURRICULUM PROPOSAL COVER SHEET**  
University-Wide Undergraduate Curriculum Committee

**I. CONTACT**

Contact Person Keith Putirka Phone x5627  
Department Geoscience

**II. PROPOSAL TYPE (Check All Appropriate Lines)**

- COURSE** Research Methods  
Suggested 20 character title
- \_\_\_\_\_ New Course\* \_\_\_\_\_  
Course Number and Full Title
- Course Revision** GEOS 380. Research Methods in the Geosciences  
Course Number and Full Title
- \_\_\_\_\_ Liberal Studies Approval  
for new or existing course \_\_\_\_\_  
Course Number and Full Title
- \_\_\_\_\_ **Course Deletion** \_\_\_\_\_  
Course Number and Full Title
- Number and/or Title**  
Change GEOS 380. Research Techniques in Geoscience  
Old Number and/or Full Old Title  
GEOS 380. Research Methods in the Geosciences  
New Number and/or Full New Title
- \_\_\_\_\_ **Course or Catalog Description Change** \_\_\_\_\_  
Course Number and Full Title
- \_\_\_\_\_ **PROGRAM:** \_\_\_\_\_ Major \_\_\_\_\_ Minor Track
- \_\_\_\_\_ **New Program\*** \_\_\_\_\_  
Program Name
- \_\_\_\_\_ **Program Revision** \_\_\_\_\_  
Program Name
- \_\_\_\_\_ **Program Deletion\*** \_\_\_\_\_  
Program Name
- \_\_\_\_\_ **Title Change** \_\_\_\_\_  
Old Program Name  
\_\_\_\_\_  
New Program Name

**III. Approvals (signatures and date)**

Carlene Richard  
Department Curriculum Committee  
[Signature]  
College Curriculum Committee

Carlene Richard  
Department Chair  
[Signature]  
College Dean

\_\_\_\_\_  
Director of Liberal Studies (where applicable)

\_\_\_\_\_  
\*Provost (where applicable)

## **Part II**

### **1. Description of the Curriculum Change**

#### **A. Catalog Description**

GEOS 380: Research Methods in the Geosciences

2 lecture hours
0 lab hours
2 credits
(2c-01-2sh)

Prerequisites: 75 credits or permission of Instructor

For students enrolled in all majors within the Geoscience department. Students will examine research methods in the geosciences by working on a project of their choosing. Students will define a problem, propose several hypotheses, collect data, and perform a quantitative analysis to test their hypotheses and propose a solution. Final results will be submitted in professional manuscript form. As preparation, students will examine various geoscience problems and data sets through the semester. Cannot be taken subsequent to GEOS 480.

#### **B. Course Objectives**

Students will:

1. Synthesize the research skills acquired in upper-level geoscience courses by selecting and carrying out a geoscience research topic of their choice.
2. Perform data analysis using software and statistical methods commonly employed by geoscientists.
3. Review and practice the diverse communication skills required for conference presentations, grant proposals and technical papers. A professional-quality abstract will be submitted for the follow up course, GEOS 480 (Geoscience Senior Seminar).

#### **C. Course Outline**

##### **1. Introduction (2 hours)**

- Course Overview
- Review of previous student research at IUP
- Introduction to lab facilities
- Identifying a problem; multiple working hypotheses and hypothesis testing

##### **2. Starting a Research Project (2 hours)**

- Use of geoscience resources (libraries, professional journals, IUP professors,

professional geologists, scientific meetings)

- Selecting a problem worthy of study.

### 3. Data Analysis (6 hours)

- Review of spreadsheets - graphing, entering formulas
- Developing a scientific model
- Introduction to the use of statistical software - regression analysis, hypothesis testing
- Use and abuse of regression results and statistical quantities
- Take-home exercises - students will present and defend the results of data analysis in an oral seminar format.
- Introduction to computer aided design software and data presentation

### 4. Research Writing (6 hours)

- Science writing: sentence and paragraph structure, citation styles, writing an Introduction
- Use of illustrations
- Peer-review of abstracts and oral presentations - following scientific journal review guidelines.
- Revision and re-submittal of written proposals based on peer review results

### 5. Student Research Projects (12 hours)

- Students undertake geoscience research under the direction of a faculty mentor, and will report on results each week.

## **D. Evaluation Methods**

The final grade for this course will be determined as follows:

1% attendance at geoscience talks (or alternative assignment)

5% literature review

7% abstract writing sample

10% written review of academic papers

29% numerical analysis assignments

24% final research paper (culminating activity)

24% student oral research presentations (culminating activity)

Grading Scale: A = 90-100%; B = 80-89%; C = 70-79%; D = 60-69%; F = 0-59%.

## **E. Required Textbooks, Supplemental Books and Readings**

All readings in this course will be taken from professional geoscience writings: technical articles in the geologic literature, research proposals and published abstracts.

## **F. Special Resource Requirements**

None. Research projects will be performed using existing IUP laboratory facilities and equipment.

## **G. Bibliography**

- Anonymous, 1992, Instructions to authors:, *Journal of Sedimentary Petrology*, v. 62, inside cover.
- Anonymous, 1992, Instructions to Bulletin authors:, *American Association of Petroleum Geologists Bulletin*, v. 76, p. ix.
- Carr, J., 1995, *Numerical analysis for the geosciences*, Prentice Hall, 592 p.
- Carson, R. J. and Sadd, J. L., Land-use-planning writing assignment for an environmental geology course, *Journal of Geologic Education*, v. 39, p. 206-212.
- Cook, C. K., 1985, *Line by Line*, Houghton Mifflin Company, Boston, MA, 219 p.
- Davis, L. E., Eves, R. L., Corner, H. M., and Urbanczyk, K. M., 1991, Student abstract writing as a tool for writing across the curriculum in large introductory-geology courses, *Journal of Geologic Education*, v. 39, p. 178-180.
- Fowler, C. M. R., 1992, *The Solid Earth*, Cambridge University Press, Cambridge, UK, 472 p.
- Hansen, W. R., 1991, *Suggestions to authors of reports of the United States Geological Survey*, US Government Printing Office.
- Isaaks, E., and Srivastava, 1989, *Applied Geostatistics*, Oxford University Press, New York, NY, 561 p.
- Jenrich, R. I., 1995, *An Introduction to Computational Statistics: Regression Analysis*, Prentice Hall, Englewood Cliffs, NJ, 364 p.
- MacDonald, R. H., 1991, Writing assignments challenge students in a physical geology course: *Journal of Geologic Education*, v. 39, p. 199-201.
- Mattox, S. R., 1999, An Exercise in forecasting the next Mauna Loa eruption, *Journal of Geologic Education*, v. 47, p. 255-260.
- Mendenhall, W. and Sincich, T., 1996, *A second course in statistics: Regression analysis*, 5th ed., Prentice Hall, Englewood Cliffs, NJ, 899 p.
- Niemitz, J. W., and Potter, N. P., 1991, the scientific method and writing in introductory landscape-development laboratories: *Journal of Geologic Education*, v. 39, p. 190-195.
- Porush, D., 1995, *A Short Guide to Writing About Science*, Harper Collins College

Publishers, New York, NY, 275 p.

Sall, J. and Lehman, A., 1996, JMP Start Statistics: A guide to statistical analysis using JMP and JMP IN software, International Thomson Publishing Company, San Francisco, CA, 521 p.

Vacher, H. L., 1999, Computational Geology 6 - solving problems, Journal of Geologic Education, v. 47, p. 280-288.\

## **2. Summary of Proposed Revisions**

### **A. Comparison of Catalog Descriptions**

#### Current Catalog Description

GEOS 380: Research Techniques in Geoscience	2 lecture hours 0 lab hours 2 credits (2c-0l-2sh)
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Prerequisites: Second-semester junior standing (75 credits or permission of Instructor)

For students majoring in some aspect of geoscience. Teaches students the techniques of geoscience research: defining a project; doing background research; proposing multiple working hypotheses and collecting evidence pertaining to each. Students will then write up their research in both abstract and professional manuscript format. Cannot be taken subsequent to GEOS 480.

#### Proposed Catalog Description

GEOS 380: Research Methods in the Geosciences	2 lecture hours 0 lab hours 2 credits (2c-0l-2sh)
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Prerequisites: 75 credits or permission of Instructor

For students enrolled in all majors within the Geoscience department. Students will learn the methods of research in the geosciences by working on a project of their choosing. Students will define a problem, propose several hypotheses, collect data, and perform a quantitative analysis to test their hypotheses and propose a solution. Final results will be submitted in professional manuscript form. As preparation, students will examine various

geoscience problems and data sets through the semester. Cannot be taken subsequent to GEOS 480.

## **B. Summary of Revisions**

- Title change to "Research Methods in the Geosciences"
- Computer applications and data analysis components are augmented. The revised course will continue to cover writing strategies, but will further emphasize the use of software of common use in the geosciences. In particular, students will gain experience in developing and testing geologic models from a quantitative standpoint using spreadsheets and statistical software, and will use computer aided design programs for presentation purposes.

## **3. Justification/Rationale for Revision:**

Data analysis skills are now among the most important skills that students acquire within a geoscience program. It is thus crucial that geoscience majors are familiar with the computer applications that geoscientists employ on a daily basis. In response to this need, several lectures and related data analysis activities have been added to GEOS 380. These added activities accomplish two goals: 1) Students are introduced to state-of-the-art statistical software that is commonly used in the geosciences. 2) Through the analysis of geoscience data, students construct their own hypotheses, and present and debate their hypotheses in class. This second aspect is essential: in this course more than any other, students will not be looking at solved problems, but instead will examine problems where the answers are not clear. Such exercises can, of course, only be approached at a junior or senior level, when students have an appropriate geoscience background. With these small additions, though, students will obtain a dramatically improved sense of how science is practiced by professional geoscientists. They will also gain a sense of what it is like to present results to a knowledgeable audience (i.e., at a professional meeting) since students will be looking at the same data sets. Finally, it is a departmental goal that students will be encouraged to enroll in either MATH 216 or MATH 217, which have been added to our list of controlled electives in our recently revised B.S. program.

## **4. Old Syllabus of Record**

Attached

## **Part III Letters of support**

Not applicable

## II. DESCRIPTION OF THE CURRICULUM CHANGE

### COURSE SYLLABUS: GS 380 Research Techniques in Geoscience

#### I. Catalog description

GS 380 Research Techniques in Geoscience	2 credits
	2 lecture hours
	0 lab hours
Prerequisites: Second-semester junior standing (75 credits or permission of instructor)	(2c-0l-2sh)

For students majoring in some aspect of geoscience. Teaches students the techniques of geoscience research: defining a project; doing background research; proposing multiple working hypotheses and collecting evidence pertaining to each. Students will then write up their research in both abstract and professional manuscript format.

#### II. Course Objectives

1. Students will synthesize the research skills acquired in upper-level geoscience courses by selecting and carrying out an actual research topic of their choice, using library resources and laboratory facilities at IUP and elsewhere. Each student will be mentored in their research project by an external IUP Geoscience faculty member in addition to the course instructor.
2. Students will learn and practice the diverse writing skills needed for conference abstracts, funding grants and technical papers in the geological sciences. Self-critiques and peer-critiques will allow students to prepare a 5-10 page manuscript summarizing their research results, as well as a professional-quality abstract for the follow-up course, GS 480 Geoscience Senior Seminar.

#### III. Course Outline

##### A. Introduction (2 hours)

Overview of course; review of previous student research at IUP; introduction to lab facilities, field equipment and available funding. Introduction to the method of multiple working hypotheses and review of scientific data-collection procedures.

##### B. Starting a Research Project (4 hours)

Use of geologic resources (libraries, professional journals, IUP professors, other professional geologists, scientific meetings) to define a research project. Individual student counseling by external IUP Geoscience faculty to select and begin a field-based, lab-based and/or library-based research project.

C. Student Research Projects (16 hours) *geoscience*

Students will carry out ~~geologic~~ research under the direction of their faculty mentor and report each week on their results. Meanwhile, the class will cover fundamentals of science writing: sentence structure, paragraph structure, report organization, use and abuse of illustrations, citation & bibliography styles, use of appendices. Lectures will be augmented by critical reading of scientific literature and by panel discussions among students.

D. Research Writing (6 hours)

Students will present and critique of abstracts of their research results to be used in the follow-up course GS 480: Geoscience Senior Seminar, which teaches techniques of oral presentation in the following spring semester. Students will also individually critique first drafts of their final scientific manuscripts, following actual scientific journal reviewing guidelines. Students will then have an opportunity to revise their work based on other students' input before turning in a final research paper.

IV. Evaluation Methods

The final grade for this course will be determined as follows:

- 10% class participation on panel discussions of papers
- 10% written reviews of academic papers
- 25% student oral research presentations
- 25% abstract writing
- 30% final research paper

V. Required Textbooks, Supplemental Books and Readings

All readings in this course will be taken from actual geologic sources: technical articles in the ~~geologic~~ literature, research proposals and published abstracts.

*geoscience*

VI. Special Resource Requirements

None. Research projects will be done using existing IUP laboratory and field equipment. IUP library resources will be augmented by trips to the Pitt Geology and Engineering Libraries.

VII. Bibliography

Anonymous, 1992, Instructions to authors: Journal of Sedimentary Petrology, v. 62, inside cover.

Anonymous, 1992, Instructions to Bulletin authors: American Association of Petroleum Geologists Bulletin, v.76, p. ix.



Carson, R.J. and Sadd, J.L., Land-use-planning writing assignment for an environmental geology course: *Journal of Geologic Education*, v. 39, p. 206-212.

Cochran, W., 1985, *Geowriting*: American Geoscience Institute.

Davis, L.E., Eves, R.L., Corner, H.M. and Urbanczyk, K.M., 1991, Student abstract writing as a tool for writing across the curriculum in large introductory-geology courses: *Journal of Geologic Education*, v. 39, p. 178-180.

Hansen, W.R., 1991, *Suggestions to authors of reports of the United States Geological Survey*: US Government Printing Office.

Niemitz, J.W. and Potter N.P., 1991, The scientific method and writing in introductory landscape-development laboratories: *Journal of Geologic Education*, v. 39, p. 190-195.

MacDonald, R.H., 1991, Writing assignments challenge students in a physical geology course: *Journal of Geologic Education*, v. 39, p. 199-201.