WINONA STATE UNIVERSITY
PROPOSAL FOR UNIVERSITY STUDIES COURSES

Department _____ GEO SCIENCE ___________________________ Date _____ 9/23/04 __________

Course No. _______ Course Name ___________________________ Credits ________

This proposal is for a(n) _______ Undergraduate Course

Applies to: ___ XX_ Major ___ XX_ Minor

___ XX_ Required ___ XX_ Elective

University Studies (A course may be approved to satisfy only one set of outcomes.):

Course Requirements:

Basic Skills: Arts & Science Core: Unity and Diversity:

_____ 1. College Reading and Writing  _____ 1. Humanities  _____ 1. Critical Analysis


_____ 4. a. Contemporary Citizenship

_____     b. Democratic Institutions

Flagged Courses:  _____ 1. Writing

_____ 2. Oral Communication

_____ 3. a. Mathematics/Statistics

_____ 4. __XX_ b. Critical Analysis

Prerequisites _____ GEOS 240 Watershed Science _____________________________________________

Provide the following information (attach materials to this proposal):

Please see “Directions for the Department” on previous page for material to be submitted.

Attach a University Studies Approval Form.

Department Contact Person for this Proposal:

____ Toby Dogwiler ___________________________ _____ x5267 _____ tdogwiler@winona.edu ____________

Name (please print) Phone e-mail address
Routing form for University Studies Course approval.

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Approved</th>
<th>Disapproved</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Department Recommendation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department Chair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td>e-mail address</td>
</tr>
<tr>
<td><strong>Dean’s Recommendation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dean of College</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>In the case of a dean’s recommendation to disapprove a proposal, a written rationale for the recommendation to disapprove shall be provided to the University Studies Subcommittee.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>USS Recommendation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Studies Director</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A2C2 Recommendation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chair of A2C2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Faculty Senate Recommendation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>President of Faculty Senate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Academic Vice President Recommendation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Vice President</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Decision of President</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>President</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please forward to Registrar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registrar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date entered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please notify department chair via e-mail that curricular change has been recorded.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Narrative for faculty colleagues discussing how GEOS 415 will address the goals of the Critical Analysis Flag requirement in the University Studies Program

From a scientist's perspective, critical analysis skills are important because they are central to the nature of science as a discipline and form the basis for the practice of science as a career. The work of science is to observe, categorize, and explain collected data. Students must learn how to recognize and evaluate data (evidence), use those data to test the validity of hypotheses, and then evaluate those results within the context of predominant scientific paradigms.

The vast majority of scientific knowledge is communicated through relatively short (4-20 page) journal articles. Because of their brevity, journal articles must be concise, yet convey the essence of the research results and their implications in such a way that other scientist can ascertain the methodologies used and the validity of the interpretations. Thus, it is essential that scientist be able to efficiently analyze journal articles and evaluate the objectives, hypotheses, methodologies, results, and conclusions.

This is important from two standpoints. Firstly, this is how scientists obtain and categorize new information and discoveries. Secondly, through the peer review process, scientists judge the merits of new work and filter valuable contributions to the field from irreproducible, sub-standard research results. Effectively reading and processing scientific journal articles is a skill that most upper-level undergraduate science majors are lacking. Just as it is important for science majors to practice and refine scientific writing skills, they need instruction and guidance in developing scientific reading skills.

Becoming adept at analyzing data and processing scientific journal articles requires keen critical analysis skills. In GEOS 415 Advanced Geomorphology, students will achieve this proficiency by meeting the following requirements outlined for the Critical Analysis Flag in the University Studies Program. These requirements are also specifically addressed in detail in the University Studies Outcomes section of the attached sample syllabus:

A. Recognize and evaluate appropriate evidence to advance a claim
   Students will individually analyze at least two journal articles over the course of the semester using a framework outlined by the instructor. In a written analysis, the student will describe the purpose and hypotheses of the research and discuss if the methods utilized by the authors were appropriate. The student will also be required to discuss the authors’ interpretation of the results and to consider if alternative explanations exist.

   For each featured article analyzed by a student, they will also have to read related articles which informed and influenced their primary article. The student will present this contextual information to the class as a brief summary and then lead a 10-15 minute class discussion of the primary article (which was also read by their classmates). This very structured approach to preparing for and executing the class discussion is designed to help the student understand the work, evaluate its validity, and gain confidence in relating the information to peers.

   Students will also practice this skill through the analysis and interpretation of empirical data that they collect as part of laboratory exercises or that the instructor provides as part of homework exercises or exams.

B. Apply critical analytical skills in making decisions or in advancing a theoretical position
   A large emphasis will be placed on forcing students to identify and assess the hypotheses presented in the literature they read or that they develop themselves to explain data collected as part of laboratory exercises. Students will be encouraged to consider if hypotheses are testable and if the methods described do in fact offer a means of testing the hypotheses. Finally, students will be required to independently evaluate the data and judge if their conclusions about the data match those presented in the literature.

C. Evaluate alternative arguments, decision strategies, or theories within a systematic framework
   Consideration of alternative hypotheses and theories is the basis of the scientific process. A healthy skepticism is an essentially trait for scientists. As such, student will be encouraged to think of and explore alternative explanations to the interpretations presented in the literature and by the instructor. Then they will be required to evaluate their own alternative hypotheses in the same way they evaluated the original hypotheses they encountered in the literature.
A. Provide a Description of the Course
Sample Syllabus

GEOS 415 Advanced Geomorphology

T/Th 12:30 – 1:50 (Lecture)
T 2:00-5:50 (Lab)
Room SLC 184

Instructor: Dr. Toby Dogwiler, PA 114A, 457-5267, tdogwiler@winona.edu

Course Catalog Description:

415 – Advanced Geomorphology —4 S.H.
Study of the landscapes and the processes that shape the Earth’s surface and shallow subsurface. The role of climate, tectonics, bedrock geology, and time as controls on geomorphic processes are explored. An emphasis is placed on developing a quantitative understanding of the mechanisms of landscape processes through indoor and outdoor laboratory exercises and field trips. Prerequisites: GEOS 240 or permission of the instructor.

This course will satisfy the University Studies Critical Analysis Flag

Course Philosophy

Geomorphology by its nature is an interdisciplinary science. This course integrates climatology, meteorology, plate tectonics, stratigraphy and bedrock geology, and Earth History toward an understanding of the geomorphic processes that have shaped the Earth’s surface during the Cenozoic era. Laboratory assignments are hands-on and involve both topographic map and aerial photo analysis as well as field-based exercises and excursions. A strong emphasis is placed on quantifying geomorphic processes, particularly using Geographic Information Systems (GIS).

Course Objectives

Course objectives will be achieved via a scholarly review of the literature, lectures, discussions, and laboratory exercises.

- Define geomorphology and its scope and relationship to other fields
- Understand the relationship between:
  - Landscapes and tectonic processes.
  - Landscapes and climate change
  - Landscapes and stratigraphy, structure, and bedrock geology
- Understand energy flow in geomorphic systems
- Investigate how Earth’s landscapes have evolved through the Cenozoic
- Investigate the processes of that have shaped Earth’s landscapes
- Explore the various types and categories of landforms and how they are interpreted with respect to formational processes

Literature

Required texts:
Easterbrook, D.J., and Kovanen, D.J., 1999, Interpretation of Landforms from Topographic

Reference List:

Instructional Plan
We will meet twice each week for 1.5 hour periods in addition to a 4 hour laboratory period. Lecture and laboratory times will be integrated and the distinction between them will be “fuzzy”. This will allow the course material, topics, and student/faculty interests to dictate the flow of the course—rather than arbitrary distinctions between “lecture time” and “laboratory time”.

Assessment
Exams
Mid-Term Exam 20%
Final Exam 20%

Literature Discussions
Each student will lead two discussions of works from the primary literature. Students will choose appropriate articles in consultation with the instructor. The discussion leader will be responsible for providing a brief (5 minute) discussion to the class of other background literature that has a bearing on the featured articles. The leader will then be responsible for facilitating a discussion 10-15 minute class discussion of the article. The leader should be prepared to pose challenging questions to the class to help stimulate discourse. At least one day prior to the discussion, the discussion leader will turn a summary analysis of the key components of the article as describe in section 1 (i-v) of the Critical Analysis Flag learning outcomes outlined below. 20%

Laboratory Exercises
Laboratory Exercises, Assignments, Field Trips 40%
(incl. assignments, reports, student presentations, required field trips)

Total 100%
Course Outline:
The following outline is tentative and will likely be modified over the course of the semester. Generally, the lecture sequence will follow the textbook sequence.

Topic/Reading Assignment
a) The scope of geomorphology
   i) Scales of landscape analysis
   ii) The Landform as the Unit of Systematic Analysis
b) Energy flow in geomorphic systems
   i) The systems concept in geomorphology
   ii) Solar Radiation
   iii) Rotational Energy
   iv) Internal Heat
c) Cenozoic Tectonism and Climate Change
   i) Plate motions, continental relief
   ii) Climate
      (1) Oceanic Circulation
      (2) CO₂ variabiliy
d) Rock Weathering and Soil Formation
   i) Mechanical processes
   ii) Chemical processes
   iii) Biologic processes
   iv) Pedology (soil formation)
e) Mass Wasting and Hillslopes
   i) Descriptive classifications
   ii) Hillslope development and evolution
f) Fluvial Processes
   iii)
i) Overland flow
ii) Channeled flow
iii) Overbank flow
iv) Erosion and transport
v) Drainage basin evolution
g) Eolian Processes and Landforms
   i) Landforms of dry regions
   ii) Tropical savannas
h) Landscape Evolution
   i) Deductive geomorphology
   ii) Rates of landscape evolution
   iii) Periglacial and Glacial Geomorphology
   i) Processes
      (1) Glaciation
   ii) Landforms
      (1) Glaciers
      (2) Erosional
         (a) Continental
         (b) Alpine
      (3) Depositional
         (a) Continental
         (b) Alpine
j) Coastal Geomorphology
   i) Shore-zone processes
   ii) Shore-zone landforms

Each lettered topic will also be explored via a laboratory exercise.

University Studies Outcomes

Critical Analysis Flag

Courses that merit the Critical Analysis Flag make essential use throughout the semester of proper techniques for analyzing the structure and validity of arguments, as opposed to techniques for examining the factual validity of, or the psychological or socioeconomic bases for, the premises of an argument. Furthermore, the overall grade for the course must depend significantly on the proper use of such techniques.

The following learning outcomes are associated with the Critical Analysis Flag:
a. recognize and evaluate appropriate evidence to advance a claim;
b. apply critical analytical skills in making decisions or in advancing a theoretical position; and
   c. evaluate alternative arguments, decision strategies, or theories within a systematic framework.

In Advanced Geomorphology we will accomplish these outcomes through the following learning activities (italicized letters correlate to the application of the above outcomes):
1) Student-led discussions of primary literature (journal articles) dealing with various aspects of geomorphology. The results of almost all technical geologic research is reported in the form of short (3-25 pages) journal articles. Most undergraduates have a difficult time reading and understanding the information presented in this type of written communication. I will help you develop a strategy for breaking down a typical journal article and learning how to extract several key pieces of information:

i. The purpose of the research. What is the problem the authors set out to study and answer [a]?

ii. The hypothesis(es) of the research. A hypothesis is clearly distinguishable from the purpose or problem because it is a specific testable prediction [b]. Good scientific literature will include a clearly stated hypothesis and perhaps multiple hypotheses [b,c]. The first critical test of the validity of a scientific paper is: will determining the validity of the proposed hypothesis lend insight toward answering the general problem the authors have presented [a,c].

iii. What are the methods? Whether the methodology is simple and straightforward or complex, the authors should demonstrate that the methods they utilized were appropriate for evaluating the validity of their original hypothesis [c].

iv. Results. The authors should present the results unvarnished—that is, in such a way that you can analyze them for yourself without their interpretation or filtration. The key question is: are the results reasonable [a]?

v. Discussion/Conclusion: Do you agree with the author’s interpretation of the results [a]? Furthermore, and of critical importance, do the results provide a means to evaluate the author’s hypothesis [a]? Can you think of alternate interpretations [b,c]? Did the authors address those or other possibilities [c].

By breaking down literature in this manner you will be able to evaluate the science presented in the paper and the significance of the results.

2) Geomorphology is a very quantitative discipline. The most common type of scientific reasoning utilized in geomorphology, and the geosciences in general, is empiricism. The empirical approach is a powerful way to analyze natural systems where it is difficult to control all the variables. Thus, laboratory exercises in this course will involve collecting and analyzing empirical data sets. You will be asked to evaluate these data and extrapolate what they tell us about geomorphic processes and compare your results and analyses to those in published investigations [a,b,c].

3) Exams in this course will be subjective. Commonly, I will give you a data set and/or graphs (usually from journal articles) and you will be asked to use those data to answer a series of questions or formulate an explanation of an observed phenomena [a,b,c].