Eastern Illinois University
New Course Proposal
GEL 3115, Introduction to Paleoclimate

Please check one:  ☑ New course  ☐ Revised course

PART I: CATALOG DESCRIPTION

1. Course prefix and number, such as ART 1000:  GEL 3115
2. Title (may not exceed 30 characters, including spaces):  Introduction to Paleoclimate
3. Long title, if any (may not exceed 100 characters, including spaces):
4. Class hours per week, lab hours per week, and credit [e.g., (3-0-3)]:  3-2-4
5. Term(s) to be offered:  ☑ Fall  ☐ Spring  ☐ Summer  ☐ On demand
6. Initial term of offering:  ☑ Fall  ☐ Spring  ☐ Summer  Year:  2010
7. Course description (not to exceed four lines):  An introduction to basic principles and applications of paleoclimatology. A review of processes and archives of climate data will be investigated using examples from Earth history.
8. Registration restrictions:
   a. Identify any equivalent courses (e.g., cross-listed course, non-honors version of an honors course).  None
   b. Prerequisite(s), including required test scores, courses, grades in courses, and technical skills. Indicate whether any prerequisite course(s) MAY be taken concurrently with the proposed/revised course.  GEL 1430 Historical Geology or permission of the instructor; may not be taken concurrently
   c. Who can waive the prerequisite(s)?  ☐ No one  ☐ Chair  ☑ Instructor  ☐ Advisor  ☐ Other (Please specify)
   d. Co-requisites (course(s) which MUST be taken concurrently with this one):
   e. Repeat status:  ☑ Course may not be repeated.
      ☐ Course may be repeated to a maximum of  hours or  times.
   f. Degree, college, major(s), level, or class to which registration in the course is restricted, if any:  None
   g. Degree, college, major(s), level, or class to be excluded from the course, if any:  None
9. Special course attributes [cultural diversity, general education (indicate component), honors, remedial, writing centered or writing intensive] Writing Active
10. Grading methods (check all that apply):  ☑ Standard letter  ☐ C/NC  ☐ Audit  ☐ ABC/NC (“Standard letter”—i.e., ABCDF—is assumed to be the default grading method unless the course description indicates otherwise.)
11. Instructional delivery method:  □ lecture  □ lab  □ lecture/lab combined  □ independent  
study/research □ internship □ performance □ practicum or clinical □ study abroad □ other

PART II: ASSURANCE OF STUDENT LEARNING

1. Objectives- Upon successful completion of this course, students will be able to:
   - Identify causes (forcings) of climate change.
   - Discuss the various components of Earth’s climate system, such as the cryosphere, atmosphere, biosphere, and hydrosphere. The student will develop a mechanistic understanding of complex component interactions and have the ability to map out both negative and positive feedback loops.
   - Investigate the variable time scales upon which different climate processes occur and calculate key features such as residence time, and periodicity.
   - Discuss the scientific evolution of tools and techniques used to interpret modern climate parameters and probe changes in Earth’s climate through geologic time.
   - Recognize and critique modern paleoclimate studies through the use of primary literature in climate science.

2. Assignments/activities the instructor will use to assess student learning:
   - Mid-term examination  20 %
   - Homework Assignments  20 %
   - Laboratory Assignments  20 %
   - Term Paper  20 %
   - Final Examination  20 %

3. Explain how instructor will determine students’ grades:

<table>
<thead>
<tr>
<th>Learning Objectives</th>
<th>20 % Mid-term Exam</th>
<th>20 % Homework Assignments</th>
<th>20 % Laboratory Assignments</th>
<th>20 % Term Paper</th>
<th>20 % Final Exam</th>
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<tbody>
<tr>
<td>Identify causes (forcings) of climate change.</td>
<td>X</td>
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Discuss the scientific evolution of tools and techniques used to interpret modern climate parameters and probe changes in Earth’s climate through geologic time.

Recognize and critique modern paleoclimate studies through the use of primary literature in climate science.

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4. Not technology delivered
5. Not graduate level course.
6. This course is writing-active. Students will be required to write up summaries of primary source reading, as part of homework assignments. Examinations will require some responses in essay format. The term paper will require a 10 page research paper focusing on some aspect of paleoclimatology.
### PART III: OUTLINE OF THE COURSE

<table>
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<tr>
<th>Week</th>
<th>Topic</th>
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| 1    | **Framework of Climate Science**  
      | Geologic Time  
      | Overview of climate science  
      | Feedbacks  
      | Tools/Proxies  
      | Lab: Archives of Paleoclimate |
| 2    | **Climate archives and data models**  
      | Sediment and ice cores  
      | Biota  
      | Speleothems  
      | Geochemistry  
      | Modeling  
      | Lab: Mapping Seafloor Sediments |
| 3    | **Tectonic Scale Climate Change: Processes**  
      | Carbon Dioxide and Greenhouse Gases  
      | Weathering  
      | Plate Tectonics  
      | Sea-Level  
      | Lab: Hiatuses, global sea-level, and sequence stratigraphy |
| 4    | **Tectonic Scale Climate Change: Examples**  
      | Himalayas/Tibetan Plateau  
      | Supercontinents  
      | Snowball Earth  
      | Lab: Paleomagnetism and Magnetostratigraphy |
| 5    | **Into the Greenhouse World**  
      | Cretaceous  
      | Paleocene-Eocene Thermal Maximum  
      | Models  
      | Lab: Microfossils and Biostratigraphy |
| 6    | **Transition from Greenhouse to Icehouse World**  
      | Middle Miocene Climate Transition  
      | Productivity changes  
      | Biota changes  
      | Lab: Antarctic Climate |
| 7    | **Review and Midterm**  
      | Framework of the Climate System  
      | Tectonic Scale Climate |
Lab: Building the Himalayas

8 Orbital Scale Climate Change
   Milankovitch cycles
   High resolution climate records
   Lab: Climate Rhythms

9 Monsoons, Sapropels and Salinity Crisis
   Indian and East-Asian Monsoon System
   Mediterranean Salinity Crisis (end Miocene)
   Pliocene and Pleistocene Sapropel Formation in the Mediterranean
   Lab: Monsoons

10 Pliocene Warm Period Controversy
   Glacial geomorphological evidence (Antarctica)
   Deep-sea records from the Southern Ocean
   Micropaleontological records from on-land sections (Antarctica)
   Lab: Evaluation of the Pliocene Warm Period Controversy

11 Ice Cores
   Antarctic records (Vostok, EPICA)
   Northern Hemisphere Records (Greenland-GISP, GRIP)
   Low latitude/high altitude records (tropical glaciers- Quelccaya,
   Kilimanjaro, Dunde, Guliya)
   Lab: Comparing ice core records from Antarctica, Greenland and
   tropics

12 North Atlantic Ocean Pleistocene Sediments
   Ice-rafted debris
   Heinrich events
   Dansgaard-Oeschger Cycles
   Mid-Pleistocene Transition
   Lab: Northern Hemisphere Glaciation

13 Last Glacial Maximum
   Glacial Geomorphological records
   Deep-sea records and reconstruction of circulation
   Tree-ring records
   Palynological studies
   Lab: Arctic Climate

14 Human Interaction with the Climate System
   Human Agriculture Impacts
   Little Ice Age
   Human Civilizations and Climate
   Using Anecdotal Records
   Lab: Using Dendrological and Palynological Archives
PART IV: PURPOSE AND NEED

1. Explain the department’s rationale for developing and proposing this course.

This course will be offered as an elective within the B.S. Geology major program, as well as, also being a course that would appeal to Geography majors interested in climate. The focus of this course will help students become aware of drivers and feedbacks within the climate system from the perspective of deep time. Studies of past climate change help to create a basis for understanding future climate change. This course will help students become better informed citizens in the ongoing debate about current and future climate change.

2. Historical Geology (GEL 1430) is the prerequisite for this course and will prepare students for this course by giving them a basic understanding of the geological history of Earth. In special situations (i.e. Geography majors), the instructor may allow enrollment without GEL 1430.

3. GEG 3415 (Climate and History) is not an equivalent course. Paleoclimatology addresses climate through the perspective of deep time, using events throughout geological history to illustrate concepts, while Climate and History addresses climate since the Last Glacial Maximum (18,000 years ago). The possible overlap with GEG 3415 was discussed with Mr. Cameron Craig. We agreed that there are minor overlaps in the section on human interactions with the climate system, framework of the climate system and discussion of proxies, although Climate and History will focus more on historical writings and art work as proxies, while Paleoclimatology will focus on geological proxies. Mr. Craig was supportive of GEL 3115.

4. This course will be offered as an elective within the B.S. Geology major program. This course might also be appropriate as an elective for Geography majors.
PART V: IMPLEMENTATION

1. Faculty member(s) to whom the course may be assigned:
   Dr. Katherine Johnson or qualified faculty members in the Geology or Geography Program.

2. Additional costs to students:
   Yes, an additional cost of $50 for a field trip.

3. Text:


PART VI: COMMUNITY COLLEGE TRANSFER

A community college course will not be judged equivalent to this course.

PART VII: APPROVALS

Date approved by the Department of Geology/Geography: January 25, 2010

Date approved by the College of Sciences Curriculum Committee: April 9, 2010

Date approved by CAA: April 22, 2010

*In **writing-active courses**, frequent, brief writing activities and assignments are required. Such activities -- some of which are to be graded -- might include five-minute in-class writing assignments, journal keeping, lab reports, essay examinations, short papers, longer papers, or a variety of other writing-to-learn activities of the instructor's invention. Writing assignments and activities in writing-active courses are designed primarily to assist students in mastering course content, secondarily to strengthen students' writing skills. In **writing-intensive courses**, several writing assignments and writing activities are required. These assignments and activities, which are to be spread over the course of the semester, serve the dual purpose of strengthening writing skills and deepening understanding of course content. At least one writing assignment is to be revised by the student after it has been read and commented on by the instructor. In writing-intensive courses, students' writing should constitute no less than 35% of the final course grade. In **writing-centered courses** (English 1001G, English 1002G, and their honors equivalents), students learn the principles and the process of writing in all of its stages, from inception to completion. The quality of students' writing is the principal determinant of the course grade. The minimum writing requirement is 20 pages (5,000 words).