FIELD METHODS: STRUCTURAL GEOLOGY AND MAPPING

The University of Toledo Department of Environmental Sciences

EEES 3310 – 001 31262

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Class meets in BO 1006 or 1010 Tuesday and Thursday from 8:30 to 10:45.
3 credit hours.

Saturday field trip required! (April, date TBA).

COURSE/CATALOG DESCRIPTION:

Rock deformation and its expression on maps; applying geometrical and trigonometric principles to solve problems involving dipping strata; stereonet applications, interpreting geological maps, constructing cross sections, geological GIS applications. Prerequisite: EEES 2100.

COURSE OVERVIEW

Tectonic forces have distorted (tilted, folded and/or fractured) once-horizontal sediments. This class focuses on characterizing these distortions and accurately plotting quantitative and qualitative geological features on maps. Once enough observations are plotted, patterns emerge that can allow the geologist to predict what lies concealed from our direct view under Earth's surface. Such knowledge can be very useful when deciding how much drilling steel is needed for an oil well.

STUDENT LEARNING OUTCOMES

- Using Global Mapper to process base maps and aerial photographs so that they can be used in other GIS.
- Measuring geological features in the field and accurately plotting observations on maps.
- Processing GPS readings and accurately plotting these observations on maps.
- Deciphering geologic maps to determine geometry and orientation of beds, folds and faults.
- Using strike/dip data to analyze and map dipping, folded, and faulted strata.
- Plotting strike/dip data on stereonets to determine fold limb, axial surface, and axis orientation to classify folds.
- Constructing geologic cross sections using map and borehole data.
- Using maps of displaced strata to classify fault geometry.

TEACHING STRATEGIES

We learn best by doing. Because geologists plot field observations on maps or aerial photographs, our first labs will focus on where to obtain these resources and process them so that the result is a geo-referenced data layer in a GIS. In subsequent labs students learn geologic mapping by taking measurements of dipping strata with Bronton pocket transits, plotting the data on basemaps and constructing geologic maps and cross sections.

PREREQUISITE: EEES 2100

REQUIRED TEXTS AND ANCILLARY MATERIALS

Readings and exercises will be made available on BlackBoard; there is no required text.

Structure and mapping labs require large 45-45-90 and 30-60-90 triangles; circular (360 degree) protractor; triangular engineer scale (10, 20, 30, 40, 50, 60 divisions/inch); compass (for drawing circles and arcs).

Each student must have a field book. It need not be new so long as there is sufficient space for new observations made in field labs in this class.

TECHNOLOGY REQUIREMENTS

Readings and laboratory instructions will be posted on **Blackboard**. Many of the mapping and surveying labs will require access to the computer cluster (BO-1010) or a personal computer.

GRADING

Two in-class exams are each worth 15% of the final grade and the final exam is worth 20%. Homework/quizzes will constitute 30% of the final grade. The final mapping project will be worth 20% of the final grade.

Midterm Grading

Homeworks completed by midterm and exam 1 will constitute the midterm grade.

Final Grading

Conventional letter,+/- scale, i.e., A >95%, A- 90-94%, B+ 87-89%, …, F<60%

COURSE SCHEDULE (subject to modification!)

1/13: Introduction, overview and pep talk (JMH & DJS) in BO 1006
1/15: Computer lab (BO 1010), getting free maps and more (DJS)
1/20: Stress, strain and failure in Earth's crust (DJS)
1/22: Computer lab: MapWindow, a free open-source GIS (DJS)
1/27: Measuring strike and dip of planar features (JMH)
1/29: Computer lab: Free elevation data to make digital elevation models (DJS)
2/3: Mapping dipping strata (JMH)
2/5: Stereo aerial photo pairs (BO 1006) (DJS)
2/10 Dipping beds (JMH)
2/12 Dipping bed map exercise (JMH)
2/17 Structural contour plotting and applications (JMH)
2/19 Structural contour lab exercise (JMH)
2/24 Apparent dip calculations and mapping (lab) (JMH)
2/26 In-class exam 1. Will include both paper and computer elements.
3/3 Stereonet plotting and analysis (JMH)
3/5 Stereonet lab exercise (JMH)
3/10, 3/12 Spring break (no class meetings)
3/17 Classifying folds with stereonets (JMH)
3/19 Fold classification lab (JMH)

3/24 Faulting and fault geometry (DJS, JMH)
3/26 Fault classification lab
4/2: Compass bearing and pace outdoor mapping (DJS). 1006.
4/7: Computer lab: processing and plotting data collected on 4/2.
4/9: Total Station and transit measurement of elevation variations (outdoor, DJS and JMH).
4/14: Computer lab: processing and plotting data collected on 4/9.
4/16: Mohr's circle exercise (JMH)
4/21:
4/23: Preparing for field
4/25 (Saturday) Field trip (tentative)
4/28: Analysis of data collected on 4/25
4/30: In-class exam 2
Final exam for this time frame is Tuesday, May 5, from 8 to 10 AM.

UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the basis of Disability (ADA): The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.)

Academic Accommodations

The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office.)