Geology 438 – Gravity and Electromagnetics, Spring 2006 (Sheriff – 4 credits)

The Fundamentals. This course will combine some of the theory and global aspects of gravity and electromagnetics as well as their practical application to regional and environmental scale problems. The early part of the semester, defined by wintry weather (if it ever happens this year), will involve mostly lecture and lab work. Later there will be equipment demos and self-directed field projects

Text: Last semester, we used Lowrie, *fundamentals of Geophysics*; that's a good text but he doesn't cover any electromagnetics. Thus I ordered Reynolds, *An Introduction to Applied and Environmental Geophysics* for this semester. I expect you to read and study the text as appropriate for topics we are covering in class. The most important use of the text is to get a different perspective/approach to a topic than mine. Other useful texts are available in the library.

Grading: One midterm (~30% each), one final (~35%), field oriented assignments (~20%), problem sets (~10%), and uncertainty (~5%). These percentage assignments are all approximate for a number of reasons. For example, if you don't do the problem sets or assignments I'll weight them as 80%. If you do them and miss them all I'll probably weight them less than 10%. Your participation and discussion during the semester will count towards your grade. . All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code:. The Code is available for review online at http://www.umt.edu/SA/VPSA/index.cfm/page/1321.

Computation: I expect you to have pretty good familiarity with spreadsheets and that you will learn some of the other software we'll need for the fieldwork.

Field Assignments: These will involve you working with two to three others and taking appropriate equipment out and performing an assigned task. You will write a short report on the experiment and results where syntax, grammar and presentation count as does content. I'll provide guidance as we progress.

Exams: I do some derivations in class and use a reasonable number of equations to develop topics. I do not expect you to memorize equations or derivations; you'll get a sheet to use during the exams with all appropriate equations. I do expect you to understand the equations, recognize the variables, and be able to use them to solve geologic problems.

Exam Schedule: I prefer to determine the midterm exam time when the schedule is right, when we get through with major topics. We'll schedule it at least a week in advance.

Course content – likely to vary, as we will adapt to the weather as much as possible**:**

Gravity

- Basic theory, mass, moment, and Earth-Moon system
- Free air, Bouguer, isostatic anomalies, isostacy and flexure of the lithosphere
- Acquisition, processing, modeling at Engineering/environmental scale

Geodetic Positioning System (GPS)

- Basic theory
- Applications at tectonic and environmental scale
- acquisition and processing for decimeter data

Electrical Resistivity

- Basic theory
- Sounding and profiling

Electromagnetics

- Basic electromagnetic theory and exploration
- Conductivity - The EM 31 Ground conductivity system.
- Imaging shallow aquifers and fluvial systems.

My goals for the course

- Introduce you to some of the topics in gravity, electromagnetics, solid-earth and exploration geophysics
- Teach some of the standard mathematical/geophysical techniques you will need to understand geophysical applications to many geologic problems
- Get you to a level where you can read and understand geophysical literature so you can evaluate geophysical applications to geological problems and so you can investigate the use of geophysics in geological problems.
- I believe that any senior level course in our department should prepare you to read the professional literature for the course's topic – that's an excellent way for you to evaluate a course as well. I try to talk about problem solving and experimental design; any good course in science should teach you the techniques and problems of the discipline. I expect you to read the textbook for the descriptive aspects of the material.