# GRANDE PRAIRIE REGIONAL COLLEGE

**DEPARTMENT OF SCIENCE**

**Fall SEMESTER 2006 - 2007**

**COURSE OUTLINE**

**EARTH SCIENCE 1050 – The Dynamic Earth Through Time**


INSTRUCTOR: **Dr. Desh Mittra** **Office: J215** **Ph. 539 2981**
E-Mail: dmittra@gprc.ab.ca


| TRANSFER CREDIT: | | | |
|---|---|---|---|
| | U. of Alberta | EAS 105 | 3 credits |
| | U. of Calgary | GLGY 201 | 3 credits |
| | U. of Lethbridge | GEOL 2060 | 3 credits |
| | Athabasca Univ. | GEOL 200 | 6 credits |

**OBJECTVE** The objective of this course is to discuss the geological nature of the Earth, including its origin, composition, and the history of life. Geological themes introduced in ES 1000 will be addressed in greater details in ES 1050. We will strive to achieve an appreciation of how the Earth has changed since its origin. Not available to students with credit in ES 1010. Prerequisite: ES 1000 or ES 1020

**COURSE OUTLINE:** The course has been designed to generate competence in the fundamental of the plate tectonics as a framework of our dynamic Earth and how it relates to the origin of major groups of minerals and rocks. Earthquakes, structural geology, and the origin of the mountain belts. Surface processes and their sedimentary products. History of life and extinctions. The main topics of this course include:

1. Earth's lithosphere, plate tectonic processes and rock formation
2. Minerals and their atomic structures
3. Igneous processes, intrusions, volcanoes and igneous rocks
4. Deformation of rocks: structural geology
5. Metamorphism and metamorphic rocks
6. Surface processes: flowing water, moving ice and blowing winds
7. Sedimentary rocks
8. Geochronology and geologic timescale
9. Precambrian Earth and fossils, Canadian Shield
10. Paleozoic Earth and fossils
11. Mesozoic Earth and fossils
12. Cenozoic Earth and fossils

**TEXTBOOKS** The Changing Earth. by Monroe and Wicander.
**LAB BOOK** EAS 1050 Laboratory Manual: U of A publication

**PROVISIONAL COURSE SCHEDULE**

**1. Introduction**
• Preamble and introduction to the course; study of the Earth as a heat engine.
• Review rock cycle.
**2. Tectonic Framework and the formation of Lithosphere (I week)**
• Plate boundaries and their characteristic processes
• Examples of the products of plate tectonics
• Plate tectonics and the Geology of Canada
**3. Minerals (11 week)**
• Main groups and classification of minerals
• Chemical composition and structures of major mineral groups
• Physical and chemical properties of rock-forming minerals
**4. Igneous processes including intrusive activity and volcanism (I week)**
• Igneous processes and rocks
• Magmatic processes and their relationship to tectonic setting
• Classification and identification of igneous rocks
**5. Structural Geology (I week)**
• Deformation processes
• Identification and characteristics of major structures: folds, faults, etc.
• Tectonic interpretation of structures; orogens and orogenic belts
**6. Metamorphism and metamorphic rocks (I week)**
• Causes and types of metamorphism
• Plate tectonic context of metamorphism
• Major types of metamorphic rocks and their characteristics
**7. Processes at the Earth's surface (2 weeks)**
• Weathering and soil
• Flow and transport of sediment by air, water, and ice
• Main types of sediment and sedimentary rock
• Sedimentary environments and their tectonic setting
• Unconformities
**8. The geological timescale (I week)**
• Introduce the geological timescale and the main subdivisions of geologic time
• Review methods of Stratigraphic correlation and measuring of geologic time
**9. Precambrian Earth and life, Canadian Shield (11 week)**
• Characteristics of the Precambrian Earth
• Paleontological database of Precambrian life
• Major elements of the Canadian Shield
**10. Paleozoic Earth and life (11 week)**
• Continental margins of North America in the Paleozoic
• Major groups of fossils from the Paleozoic
**11. Mesozoic and Cenozoic Earth and life (I week)**
• History of North America in the Mesozoic and Cenozoic; Rocky Mountains
• Major groups of Mesozoic fossils: dinosaurs, invertebrates
• Major Cenozoic fossils: mammals
• History of Glaciation

**Laboratory classes**

• No lab held during week 1.

**Week 2**: Plate tectonics: Use maps and examples to show geornorphology of tectonic zones and then calculate spreading / subduction rates.

**Week 3:** Minerals and their atomic structure: Develop basic skills in mineral description by investigating and reporting the physical characteristics of the main rock-forming minerals.

**Week 4:** Igneous processes and rocks: Learn the scale and morphology of igneous processes through geological map interpretation exercises and air-photo interpretation; also develop basic skills in rock description by investigating and reporting the main igneous rock types.

**Week 5:** Structural Geology: build structural block diagrams and interpret maps.

**Week 6:** Metamorphism and metamorphic rocks: Mapping metamorphic zones (e.g. Barrovian sequence); develop basic skills in rock description by investigating and reporting the main metamorphic rock types.

**NO LAB WEEK 7, RESERVED FOR MIDTERM WEEK.**

**Week 8:** Earth Surface Processes: Learn the scale and morphology of sedimentary processes through geological map interpretation exercises and air-photo interpretation; also develop basic skills in rock description by investigating and reporting the main sedimentary rock types.

**Week 9:** The Geological Timescale: Develop an appreciation of geological time and the relative apportionments of Earth's geological phases with respect to absolute time; also to memorize aspects of the geological time scale.

**Week 10:** Precambrian Earth and life, Canadian Shield: Precambrian fossils, configuration of cratons, examples of shield rocks.

**Week 11:** Paleozoic Earth and life; the Paleozoic of North America: Develop basic skills in fossil description by describing and sketching the typical fauna (from fossil examples) of the periods.

**Week 12:** Mesozoic and Cenozoic Earth and life; the Mesozoic and Cenozoic of North America: Develop basic skills in fossil description by describing and sketching the typical fauna (from fossil examples) of the periods.

**Last day of classes – TBA**

**ASSIGNMENTS** You will be given weekly assignments consisting of multiple choice, true/false or fill in the blanks type questions. These assignments are open book and are available on Black Board. You will be given two choices and marks will be recorded out of the best. The test will be available for two weeks before the due date. If you do not complete your test within given time, a **20%** deduction per day will be applied to your score.

**Minitest** Every second week, you may be given a mini-test at the start of class which will be approximately 15 minutes long. Labs will also have quizzes.

**MARKS DISTRIBUTION**

| | |
|---|---|
| Mini tests | 5% |
| Assignments | 15% |
| Lab quiz | 10% |
| Weekly labs | 10% |
| Midterm exam | 15% |
| Lab final | 15% (Two finals 7.5% each) |
| Final exam | 30% |
| | 100% |

**Note** **- All books and materials are available at the Bookstore**
- labs could be used for studying rocks, minerals or maps other than scheduled lab hours by pre-arranging with Medha Karnik, our lab technologist.