Grande Prairie Regional College
Department of Science
ES 1050- **The Dynamic Earth through Time**
Course Outline
Winter 2007 - 08

Lecture	Section A3	M	1:00 - 2:20	Room H211
		F	11:30 – 12:50	Room H211
Labs	L1	W	14:30 - 17:20	Room J107

Instructor: **Dr. Desh Mittra**
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TRANSFER CREDIT:	U. of Alberta	EAS 105	3 credits
	U. of Calgary	GLGY 203	3 credits

Course Summary

The plate tectonic framework of a dynamic Earth as it relates to the origin of major groups of minerals and rocks. Earthquakes, Structural geology and the origin of mountain belts. Surface processes and their sedimentary products. History of life and extinctions.
Not available to students with credit in ES 1010. Prerequisite: ES 1000 or ES1020.

Introduction

The objective of this course is to discuss the geological nature of Earth, including its origins, 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. The main topics of this course include:

1. Introduction to the course materials.
2. Earth's lithosphere, plate tectonic processes and rock formation.
3. Minerals and their atomic structure.
4. Igneous processes including magmatic intrusions and volcanoes with an introduction to igneous rocks.
5. Deformation of rocks: structural geology.
6. Metamorphism, with an introduction to metamorphic rocks.
7. Surface processes and their products: the geological significance of flowing water, moving ice and blowing air.
8. Introduction to sedimentary rocks.
9. Geochronology: the geological timescale.
10. Precambrian Earth and Precambrian fossils, Canadian Shield.
11. Paleozoic Earth and Paleozoic fossils.
12. Mesozoic Earth and Mesozoic fossils.
13. Cenozoic Earth and Cenozoic fossils.

Recommended Books

1. **Monroe and Wicander**: The Changing Earth, Thompson
2. Skinner Porter and Botkin: The Blue Planet, John Wiley and Sons (your ES1000 textbook is a good auxiliary reference)
3. Lab Exercises for ES 1050

Laboratory Work

Laboratory work will be conducted weekly starting the first week of classes.
The lab will run 3 hours per week. Attendance is mandatory. During this time you will receive the lab assignment. Students shall hand in completed assignments before or at the end of **that** lab session.

NOTE: **There is NO Lab Final Exam**. Weekly labs and quizzes carry full weight.

Mark Distribution

Weekly Labs	20%
Laboratory Quizzes	10%
Assignments	15%
Mid Term Exam	20%
Final Term Exam	35%

PROVISIONAL COURSE SCHEDULE

1. Introduction

- Introduction to the course; study of the Earth as a heat engine.
- Review rock cycle.

2. Tectonic Framework and the formation of Lithosphere (1 week)

- Plate boundaries and their characteristic processes
- Examples of the products of plate tectonics
- Plate tectonics and the Geology of Canada

3. Minerals (1 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 (1 week)

- Igneous processes and rocks
- Magmatic processes and their relationship to tectonic setting
- Classification and identification of igneous rocks

5. Structural Geology (1 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 (1 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 (1 week)

- Introduce the geological timescale and the main subdivisions of geologic time
- Review methods of stratigraphic correlation and measuring of geologic time
- Introduction to the concepts of evolution.

9. Precambrian Earth and life, Canadian Shield (1 week)

- Characteristics of the Precambrian Earth
- Paleontological database of Precambrian life
- Major elements of the Canadian Shield

10. Paleozoic Earth and life (1 week)

- Continental margins of North America in the Paleozoic
- Major groups of fossils from the Paleozoic

11. Mesozoic and Cenozoic Earth and life (1 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

Week of:	**Lab number and general topic**
Jan. 8	No lab held during this weeks
Jan. 15	Lab 1: Minerals and their atomic structure: Develop basic skills in mineral description by investigating and reporting the physical characteristics of the main rock-forming minerals.
Jan. 22	Lab 2: 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.
Jan. 29	Lab 3: Structural Geology: build structural block diagrams and interpret maps.
Feb. 5	Lab 4: 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.

Feb. 12	Lab 5: Sedimentary Rocks: 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.
Feb. 19, 26	**NO LABS DURING THESE WEEKS**
Mar. 4	Lab 6: Plate tectonics: Use maps and examples to show geomorphology of tectonic zones and then calculate spreading / subduction rates.
Mar. 11	Lab 7: Precambrian Earth and life, Canadian Shield: Precambrian fossils, configuration of cratons, examples of shield rocks.
Mar. 18	Lab 8: 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.
Mar. 25	Lab 9: Mesozoic and Earth and life; the Mesozoic of North America: Develop basic skills in fossil description by describing and sketching the typical fauna (from fossil examples) of the periods.
Apr. 1	Lab 10: Cenozoic Earth and life; the Cenozoic of North America: Develop basic skills in fossil description by describing and sketching the typical fauna (from fossil examples) of the periods.
Apr. 8	**Review**