CAS/GRS Course Revision Proposal Form

This form is to be used when proposing a revision of an existing CAS or GRS course.

Once completed, this form should be submitted to Senior Academic Administrator Peter Law (617-353-7243) as a PDF file to pgl@bu.edu.

For further information or assistance, contact Associate Dean Susan Jackson (617-353-2410; sjackson@bu.edu) about CAS courses or Associate Dean Jeffrey Hughes (617-353-2690; hughes@bu.edu) about GRS courses.

DEPARTMENT OR PROGRAM: Earth & Environment

DATE SUBMITTED: June 30th, 2016

CURRENT COURSE NUMBER: CAS ES 424
CURRENT COURSE NAME: Igneous and Metamorphic Petrology
CURRENT 40 WORD COURSE DESCRIPTION: Recognition and interpretation of common igneous and metamorphic rocks, both in hand sample and in thin section; the relationships between rocks and the tectonic environments in which they formed. Three hours lecture, three hours lab, and occasional field trips.

CURRENT CROSS-LISTING DEPARTMENT/PROGRAM, if any:

TO BE OFFERED NEXT: Sem./Year: Spring / 2017
INSTRUCTOR(S): Lawford Anderson
DEPARTMENT CONTACT NAME AND POSITION: David Marchant
DEPARTMENT CONTACT EMAIL AND PHONE: marchant@bu.edu, 617-353-2525

ITEMS PROPOSED FOR REVISION (check all that apply):

- [X] Course Number
- [X] Title
- [X] Short Title
- [ ] Credits
- [ ] Cross-listing
- [X] 40 Word Description
- [X] Prerequisites
- [ ] Divisional Studies Credit
- [ ] Other (Explain)

Notes: The “short title” appears in the course inventory and on student transcripts and must be 15 characters maximum including spaces. The “40 word description” appears in the CAS/GRS Bulletin.
PROPOSED REVISIONS: For each item checked above, provide the current information, then the proposed information, then a brief explanation for the proposed change, including the intended impact of the change.

1. Course Number
   a. Current information: CAS ES 424
   b. Proposed information: CAS ES 300
   c. Explanation & impact: Because ES 222 Mineralogy (required prerequisite for ES 424) is no longer offered due to faculty departures, ES 424 cannot be taught in its current state. As a result, ES 424 will be modified so that it reflects a blend of ES 222 and ES 424. This new course, ES 300, will introduce students to the full breadth of earth’s rocky materials; it is designed so that it will be accessible - and of interest to - students in all three “groups” within our Earth & Environmental Science major (Ecosystems, Earth & Climate, Earth Observations). The new number, ES 300, reflects the blend of our previous 2XX and 4XX level courses.

2. Title
   a. Current information: Igneous and Metamorphic Petrology
   b. Proposed information: Earth’s Rocky Materials
   c. Explanation & impact: The new title reflects the shift in course content to a more general geological focus and recognizes the course as a true blend of ES 222 (mineralogy) and ES 424 (igneous and metamorphic petrology). Once ES 300 is offered, we will no longer offer ES 222 or ES 424.

3. Short Title
   a. Current information: IGN&MET Petrol
   b. Proposed information: EARTH ROCK MAT
   c. Explanation & impact: see above

4. 40 word description
   a. Current information: Recognition and interpretation of common igneous and metamorphic rocks, both in hand sample and in thin section; the relationships between rocks and the tectonic environments in which they formed. Three hours lecture, three hours lab, and occasional field trips.
   b. Proposed information: Utilizing an Earth Systems approach, this course begins with the mineral phases of the core and mantle. Crustal mineralogy and petrology follow, examining how minerals and the rocks that contain them are produced by magmatic, metamorphic, hypothermal, and surface processes. Weekly two-hour labs and a required field trip.
   c. Explanation & impact: This new description captures the revised content of the course and its blend of Mineralogy and Igneous and Metamorphic Petrology.
5. Prerequisites

a. Current information: CAS ES 222

b. **Proposed information:** CAS ES 107; or consent of instructor.

c. Explanation & impact: All undergraduates in the Department of Earth & Environment must complete ES 107 (Introduction to Climate and Earth System Science). ES 107 contains a two-week section and accompanying laboratory exercise on Plate Tectonics and surface processes; this information will be sufficient background for all students entering ES 300.

**IMPACT ON OTHER DEPARTMENTS/PROGRAMS:** Will any of these changes have an impact on students pursuing the degree requirements or expectations of other departments, programs, or schools? Check one: [ ] Yes [X] No

If YES, please identify impacts and attach cognate comment from the appropriate department/program/school.

**RESOURCE NEEDS: STAFFING, FACILITIES, AND EQUIPMENT:** As a result of the proposed changes, will there be any changes in the staffing, special facilities or equipment needs of the course (e.g. laboratory, library, instructional technology, technical resources, etc)? Check one: [ ] Yes [X] No

If YES, explain further and indicate whether currently available staffing, facilities, and equipment are adequate for the proposed course. (NOTE: Approval of proposed revisions does not imply a change in resource commitments on the part of CAS.)

**FURTHER INFORMATION THAT MUST BE SUBMITTED IN ORDER FOR THIS PROPOSAL TO BE CONSIDERED:**

1. A complete week-by-week SYLLABUS with student learning objectives, readings, and assignments that reflects the proposed changes (see guidelines on “Writing a Syllabus” on the Center for Excellence and Innovation in Teaching website. Be sure that syllabus includes your expectations for academic honesty, with URL for pertinent undergraduate or GRS academic conduct code(s).

2. Cognate comment from chairs or directors of relevant departments and/or programs. Use the form available here. You can consult with Susan Jackson (CAS) or Jeffrey Hughes (GRS) to determine which departments or programs inside and outside of CAS would be appropriate.

**DEPARTMENT APPROVAL:**

__________________________________________  ________________________
Department Chair  Date

__________________________________________  ________________________
Other Department Chair(s) (for cross-listed courses)  Date
DEAN'S OFFICE CURRICULUM ADMINISTRATOR USE ONLY

CAS/GRS CURRICULUM COMMITTEE APPROVAL:

☐ Approved Date: ______________________

☐ Tabled Date: ______________________

☐ Not Approved Date: ______________________

Divisional Studies Credit:

☐ Endorsed

☐ HU

☐ MCS

☐ NS

☐ SS

☐ Not endorsed

______________________________
Curriculum Committee Chair Signature and Date

Comments:

PROVISIONAL APPROVAL REQUESTED for Semester/Year ______________________

______________________________
Dean of Arts & Sciences Signature and Date

Comments:

CAS FACULTY: Faculty Meeting Date: ______________________

☐ Approved ☐ Not Approved

______________________________
Curriculum Administrator Signature and Date

Comments:
Earth’s Rocky Materials – CAS ES 300
(Spring 2017)

Course Description

After a short foray into the atom, mineral properties, and crystal structures, this course, utilizing an Earth Systems approach, begins its exploration with the mineral phases of the core and deep mantle. Crustal mineralogy and petrology follows, including minerals, and the rocks that contain them, produced from both magmatic and metamorphic processes. Subsequent sections investigate near-surface hydrothermal systems and minerals and rocks produced in surface (sedimentary) processes. The final sections will look at the mineralogy of the biosphere, including extreme life, and mineral health issues.

Professor..............................
J. Lawford Anderson
Office: STO 141j, 617-358-6668
E-mail: lawford@bu.edu
Office hours*: 10-12:00W, 12:30-2:00 Th (also available all week)
*Please call or e-mail in advance

Teaching Fellow..............
TBA

Learning Assistant ……
TBA

Lecture.................................
11:00 - 12:15 TTh, room TBA
Lab.........................................
2:30 - 4:15 F, CAS B08b

Field Trip.........................
The Cape Ann Intrusion, Saturday, April 15

Textbook.............................

Lecture Exams.....................
Midterm 1: February 16
Midterm 2: March 30
Final Exam, TBA

Basis of Grade............... Lecture 75%
20% each for each midterm
25 % for the final
5% for PowerPoint – due April 20
5% for field trip – April 15

Lab 25%

Academic Conduct............... Students are expected to uphold Boston University's Academic Conduct Code, http://www.bu.edu/academics/policies/academic-conduct-code/.
# ES 300 Earth’s Rocky Materials – Schedule of Lectures

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Date</th>
<th>Lecture Topic</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan. 19</td>
<td>Introduction to Minerals</td>
<td>Ch. 2</td>
</tr>
<tr>
<td>2</td>
<td>Jan. 24</td>
<td>Physical Properties of Minerals</td>
<td>Ch. 3</td>
</tr>
<tr>
<td>3</td>
<td>Jan. 26</td>
<td>Earth’s Core and Mantle</td>
<td>Ch. 1</td>
</tr>
<tr>
<td>4</td>
<td>Jan. 31</td>
<td>Crustal Mineralogy</td>
<td>Ch. 7</td>
</tr>
<tr>
<td>5</td>
<td>Feb. 2</td>
<td>Classification of Igneous Rocks</td>
<td>Ch. 8</td>
</tr>
<tr>
<td>6</td>
<td>Feb. 7</td>
<td>Magma Processes</td>
<td>Ch. 8, 9</td>
</tr>
<tr>
<td>7</td>
<td>Feb. 9</td>
<td>Origin of Basalt and Rhyolite</td>
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<tr>
<td>8</td>
<td>Feb. 14</td>
<td>Isotope Petrology</td>
<td>Ch. 9</td>
</tr>
<tr>
<td>9</td>
<td>Feb. 16</td>
<td><strong>Midterm 1</strong></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Feb. 21</td>
<td>No class, Monday classes</td>
<td></td>
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<tr>
<td>11</td>
<td>Feb. 23</td>
<td>Magmatism vs Tectonics</td>
<td>Ch. 9</td>
</tr>
<tr>
<td>12</td>
<td>Mar. 2</td>
<td>Ocean Magmatism – MOR, OI, &amp; IA</td>
<td>Ch. 9</td>
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<td></td>
<td></td>
<td>A-type Magmatism</td>
<td>Ch. 9</td>
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<td>Spring Recess – March 5 -12</td>
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<tr>
<td>13</td>
<td>Mar. 14</td>
<td>Introduction to Metamorphic Petrology</td>
<td>Ch. 13, 14</td>
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<tr>
<td>14</td>
<td>Mar. 16</td>
<td>Metamorphism and Tectonics</td>
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<tr>
<td>15</td>
<td>Mar. 21</td>
<td>Metamorphism of Pelitic Rocks</td>
<td>Ch. 14</td>
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<tr>
<td>16</td>
<td>Mar. 23</td>
<td>Metamorphism of Calcareous Rocks</td>
<td>Ch. 14</td>
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<tr>
<td>17</td>
<td>Mar. 28</td>
<td>Metamorphic Facies and Mafic Rocks</td>
<td>Ch. 14</td>
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<tr>
<td>18</td>
<td>Mar. 30</td>
<td><strong>Midterm 2</strong></td>
<td></td>
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<tr>
<td>19</td>
<td>Apr. 4</td>
<td>Thermobarometry</td>
<td>Ch. 14</td>
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<tr>
<td>20</td>
<td>Apr. 6</td>
<td>Hydrothermal Systems &amp; Gold</td>
<td>Ch. 15</td>
</tr>
<tr>
<td>21</td>
<td>Apr. 11</td>
<td>Classification of Sedimentary Rocks</td>
<td>Ch. 10, 12</td>
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<tr>
<td>22</td>
<td>Apr. 13</td>
<td>Sedimentary Systems</td>
<td>Ch. 11</td>
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<td></td>
<td></td>
<td><em><strong>Field Trip to Cape Ann, Saturday, April 15</strong></em></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Apr. 18</td>
<td>Sedimentary Processes: Carbonates</td>
<td>Ch. 12</td>
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<tr>
<td>24</td>
<td>Apr. 20</td>
<td>Sedimentary Processes: Evaporates</td>
<td>Ch. 12</td>
</tr>
<tr>
<td>26</td>
<td>Apr. 27</td>
<td>Minerals and Extreme Life</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>May 2</td>
<td>Mineral Health Issues</td>
<td>Ch. 17</td>
</tr>
</tbody>
</table>
Guidelines for PowerPoint

ES 300 Earth’s Rocky Materials

**PowerPoint**

**Topic**: approved by instructor

**Goal**: Creative and new PowerPoint on any aspect of mineralogy and petrology with the quality and length to appropriate for a 10 minute presentation on a topic beyond what was covered in class.

**File name**: yourlastname_topic.ppt (i.e., anderson_rapakivi_granites.ppt)

**References**: the sources of text, figures, tables, and pictures should be acknowledged, including the full address of all websites. This could be done on the last page or on each frame, as convenient.

**Due date**: April 20

**Submission**: by e-mail or bring to class on a thumb drive.

**Grading**: The Powerpoint will be judged on the originality of the topic, quality of the presentation and argument, and appropriateness of its length. This includes both the ppt and the actual oral presentation.
2017 SPRING FIELD TRIP
ES 300 – EARTH’S ROCKY MATERIALS

Geologic Wonders of Cape Ann

Dates: Saturday, April 15
Departure: 9:00 am, parking lot behind Stone/CAS
Return: about 5:00 pm
If it’s raining? We go!

Weather and clothes: daytime temperatures may be pleasant with beautiful sunshine, but there could also be rain, thunderstorms, and strong winds....bring clothes for the unexpected.

Food: Bring lunch and water

What else to bring:

- comfortable shoes or boots for walking
- note-taking materials
- daypack
- hand lens (to be earlier provided)
- hand magnet (to be earlier provided)
- rock hammer (optional)
<table>
<thead>
<tr>
<th>Lab</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab 1</td>
<td>Jan 27</td>
<td>Properties of Minerals</td>
</tr>
<tr>
<td>Lab 2</td>
<td>Feb 3</td>
<td>Non-silicate Mineral Identification</td>
</tr>
<tr>
<td>Lab 3</td>
<td>Feb 10</td>
<td>X-ray diffraction and Silicate Mineral Identification</td>
</tr>
<tr>
<td>Lab 4</td>
<td>Feb 17</td>
<td>Introduction to Igneous Rocks and use of the Microscope</td>
</tr>
<tr>
<td>Lab 5</td>
<td>Feb 24</td>
<td>Petrography and Hand Sample Description of Gabbroic Igneous Rocks</td>
</tr>
<tr>
<td>Lab 6</td>
<td>Mar 3</td>
<td>Petrography and Hand Sample Description of Granitic Igneous Rocks</td>
</tr>
<tr>
<td>Lab 7</td>
<td>Mar 17</td>
<td>Introduction to Metamorphic Rocks</td>
</tr>
<tr>
<td>Lab 8</td>
<td>Mar 24</td>
<td>Petrography and Hand Sample Description of Pelitic Metamorphic Rocks</td>
</tr>
<tr>
<td>Lab 9</td>
<td>Mar 31</td>
<td>Petrography and Hand Sample Description of Calcic Metamorphic Rocks</td>
</tr>
<tr>
<td>Lab 10</td>
<td>April 7</td>
<td>Hydrothermal Ore Rocks</td>
</tr>
<tr>
<td>Lab 11</td>
<td>April 14</td>
<td>Introduction to Sedimentary Rocks</td>
</tr>
<tr>
<td>Lab 12</td>
<td>April 21</td>
<td>Petrography and Hand Sample Description of Sedimentary Rocks</td>
</tr>
<tr>
<td>Lab 13</td>
<td>April 28</td>
<td>Lab Exam</td>
</tr>
</tbody>
</table>
ES 300 Earth’s Rocky Materials Learning Outcomes

After this course you will be able to

1. Identify and know the significance of common minerals of Earth, how they form, and their use.
2. Identify any common igneous, metamorphic, or sedimentary rock, how it formed, and its geologic significance.
3. Work with the petrographic microscope and X-ray diffraction spectrometer to better analyze minerals and rocks.
4. Understand how to utilize the isotopic and elemental chemistry of minerals to determine their age and the pressure and temperature conditions under which they formed.
5. Be able to model whole rock elemental and isotopic chemical data to better constrain the origin of the planet, not just Earth.
6. Identify ore minerals, how they formed, and their use in society.
7. Appreciate how minerals support life and also can be a hazard to life.
8. Approach any outcrop of rock, make a careful visual and detailed observation and be able to offer an geologic explanation of the significance of that exposure.