August 28, 2015
9:30-11:30am
ADM 204

I. Roll Call
( ) Arlene Schmuland (LIB, Chair)  ( ) Hsing-Wen Hu (COE)
( ) Anthony Paris (FS)  ( ) Cindy Knall (COH)
( ) Jervette Ward (CAS)  ( ) Bogdan Hoanca (CBPP)
( ) Sam Thiru (CAS)  ( ) Clayton Trotter (CBPP)
( ) Peter Olsson (CTC)

Ex-Officio Members
( ) Susan Kalina (OAA)
( ) Lora Volden (Registrar)
( ) Gianna Niva (Scheduling and Publications)

II. Approval of Agenda (pg. 1)

III. Approval of Meeting Summary (pg. 2)

IV. Administrative Reports
A. Vice Provost, Susan Kalina

B. University Registrar, Lora Volden

C. GAB Chair, Arlene Schmuland

V. Program/Course Action Request - Second Readings

VI. Program/Course Action Request – First Readings
Chg  BA A634  Organizational Design and Development (3 cr)(3+0)(pg. 3-6)
Add GEOL A636  Petroleum Geology (Stacked with GEOL A436)(3 cr)(3+0)(pg. 7-16)
Add GEOL A637  Adv Dep Systems and Stratigraphy (Stacked with GEOL A437)
(3 cr)(3+0)(pg. 17-28)
Add GEOL A638  Adv Sed Petrology and Diagenesis (Stacked with GEOL A438)
(3 cr)(3+0)(pg. 29-38)
Add GEOL A640  Advanced Hydrogeology (Stacked with GEOL A440)(3 cr)(3+0)(pg. 39-49)
Add GEOL A645  Advanced Geothermal Energy (Stacked with GEOL A445)(3 cr)(3+0)(pg. 50-61)
Add GEOL A657  Advanced Geology of Alaska (Stacked with GEOL A457)(3 cr)(3+0)(pg. 62-69)
ADD GEOL A699  Graduate Thesis (1-6 cr)(0+3-18)(pg. 70-72)

VII. Old Business
VIII. New Business
IX. Informational Items and Adjournment
Graduate Academic Board
April 24, 2015
9:30-11:30am
ADM 204

I. Roll Call
(x) Arlene Schmuland (x) Anthony Paris (x) Hsing-Wen Hu
(x) Cindy Knall (x) Dennis Drinka (x) Clayton Trotter
(x) Jervette Ward (x) Parker McWilliams (x) Sam Thiru
(x) Peter Olsson

Ex-Officio Members
(x) David Yesner
(x) Lora Volden
(x) Scheduling/Publications

II. Approval of Agenda (pg. 1)
Approved

III. Approval of Meeting Summary (pg. 2)
Approved

IV. Administrative Reports
A. Associate Dean of the Graduate School David Yesner
B. University Registrar Lora Volden
C. GAB Chair Arlene Schmuland

V. Program/Course Action Request - Second Readings

VI. Program/Course Action Request – First Readings
Chg BA A634 Organizational Design and Development (3 cr)(3+0)(pg. 3-6)
Postponed

Chg Master of Science, Civil Engineering (pg. 7-14)
Waive for first reading, approve for second

Chg Master of Civil Engineering (pg. 15-21)
Waive for first reading, approve for second

VII. Old Business

VIII. New Business
A. 2015-2016 Election of New Chair
Arlene Schmuland was elected to continue as chair for 2015-2016

IX. Informational Items and Adjournment
A. Graduate Academic Board Report to Faculty Senate (pg. 22)
1a. School or College  
CB CBPP

1b. Division  
ADBP Division of Business Programs

1c. Department  
BA

2. Course Prefix  
BA

3. Course Number  
A634

4. Previous Course Prefix & Number  
N/A

5a. Credits/CEUs  
3

5b. Contact Hours  
(Lecture + Lab) (3+0)

6. Complete Course Title  
Organizational Design and Development  
Org. Design and Development

Abbreviated Title for Transcript (30 character)  
Org. Design and Development

7. Type of Course  
☑ Academic  ☐ Preparatory/Development  ☐ Non-credit  ☐ CEU  ☐ Professional Development

8. Type of Action:  
☐ Add  ☒ Change  ☐ Delete

If a change, mark appropriate boxes:

- Prefix  ☐
- Course Number  ☐
- Credits  ☐
- Title  ☐
- Grading Basis  ☐
- Course Description  ☐
- Test Score Prerequisites  ☐
- Co-requisites  ☐
- Automatic Restrictions  ☐
- Class  ☐
- Level  ☐
- College  ☐
- Major  ☐
- General Education Requirement  ☐
- Repeat Status  ☐
- Contact Hours  ☐
- Cross-Listed/Stacked  ☐
- Registration Restrictions  ☐
- Other Update CCG (please specify)  ☐

9. Repeat Status No  
# of Repeats  
Max Credits

10. Grading Basis  
☑ A-F  ☐ P/NP  ☐ NG

11. Implementation Date  
From: Fall/2015  
To: /9999

12. ☐ Cross Listed with  
Stacked with  
Cross-Listed Coordination Signature

13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at www.uaa.alaska.edu/governance.

<table>
<thead>
<tr>
<th>Impacted Program/Course</th>
<th>Date of Coordination</th>
<th>Chair/Coordinator Contacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBA, General Management</td>
<td>03/20/2015</td>
<td>Ed Forrest &amp; Bogdan Hoanca</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Initiator Name (typed):  
Terry Nelson  
Initiator Signed Initials:  
Date:  

13b. Coordination Email  
Date: 04/03/2015  
submitted to Faculty Listerv: (uae-faculty@lists.uaa.alaska.edu)

13c. Coordination with Library Liaison  
Date: 04/03/2015

14. General Education Requirement  
Mark appropriate box:  
☐ Oral Communication  ☐ Written Communication  ☐ Quantitative Skills  ☐ Humanities  
☐ Fine Arts  ☐ Social Sciences  ☐ Natural Sciences  ☐ Integrative Capstone

15. Course Description (suggested length 20 to 50 words)

Explores factors, conditions, and practices that lead to creating and maintaining organizational success. Examines alternative methods of determining organizational effectiveness. Presents organizational design based on contingency theory perspective and examines major organizational dilemmas and dysfunctions. Surveys and applies critical tools available for organizational development.

16a. Course Prerequisite(s) (list prefix and number or test code and score)  
BA A632

16b. Co-requisite(s) (concurrent enrollment required)  
N/A

16c. Automatic Restriction(s)  
☐ College  ☐ Major  ☐ Class  ☐ Level

16d. Registration Restriction(s) (non-codable)  
Graduate standing

17. ☒ Mark if course has fees  
Standard CBPP computer lab fee

18. ☐ Mark if course is a selected topic course

19. Justification for Action  
To update course resources and textbook as part of the CBPP Five-Year Review Program.

Initiator (faculty only)  
Terry Nelson  
Initiator (TYPE NAME)  

Initiator (faculty only)  
Terry Nelson  
Initiator (TYPE NAME)  

Mark if course has fees  
Standard CBPP computer lab fee

Mark if course is a selected topic course

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Initiator (faculty only)  
Terry Nelson  
Initiator (TYPE NAME)  

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Terry Nelson  
Initiator (TYPE NAME)  

Mark if course has fees  
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Mark if course is a selected topic course

To update course resources and textbook as part of the CBPP Five-Year Review Program.

Initiator (faculty only)  
Terry Nelson  
Initiator (TYPE NAME)  

Mark if course has fees  
Standard CBPP computer lab fee

Mark if course is a selected topic course

To update course resources and textbook as part of the CBPP Five-Year Review Program.

Initiator (faculty only)  
Terry Nelson  
Initiator (TYPE NAME)  

Mark if course has fees  
Standard CBPP computer lab fee

Mark if course is a selected topic course

To update course resources and textbook as part of the CBPP Five-Year Review Program.
I. Date Initiated  
August 24, 2015

II. Course Information  
College/School: College of Business and Public Policy  
Department: Business Administration  
Program: Master of Business Administration, General Management  
Course Title: Organizational Design and Development  
Course Number: A634  
Credits: 3  
Contact Hours: 3 per week x 15 weeks = 45 hours  
0 lab hours  
6 hours outside of class per week x 15 weeks = 90 hours  
Grading Basis: A-F  
Course Description: Explores factors, conditions, and practices that lead to creating and maintaining organizational success. Examines alternative methods of determining organizational effectiveness. Presents organizational design based on contingency theory perspective and examines major organizational dilemmas and dysfunctions. Surveys and applies critical tools available for organizational development.  
Course Prerequisites: BA A632  
Registration Restrictions: Graduate Standing  
Fees: Standard CBPP computer lab fee

III. Course Activities  
A. Lecture  
B. Discussion  
C. Group work

IV. Course Level Justification  
Students rely on knowledge gained at the undergraduate level and the activities required in the course necessitate self-direction. The course is one of four options required for the Executive Focus of the Master of Business Administration.
V. Outline
A. Overview of Complex Organizations
B. Organizational Strategy, Structure, and Variety
C. Governance: Boards, Committee, and the “Principle-Agent” Problem
D. Organizational Design and Globalization
E. Organizational Design and Technology
F. Management of Growth
G. Inter-Organizational Relations
H. Innovation and Change Management
I. Decision Making Processes
J. Decision Making: Mistake, Misconduct, and Error

VI. Instructional Goals and Student Learning Outcomes

A. Instructional Goals.
The instructor will:

1. Review and interpret the academic and practitioners’ understanding of organizations, their structures, and processes.
2. Identify the tools and practices available to successfully intervene in the development and change of organizations.
3. Demonstrate how to apply the concepts and methods learned by performing an “Organizational Diagnosis” on an organization.

B. Student Learning Outcomes.
Students will be able to:

<table>
<thead>
<tr>
<th>Assessment Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams and group presentations</td>
</tr>
<tr>
<td>Group research papers</td>
</tr>
<tr>
<td>Group research papers and group presentations</td>
</tr>
</tbody>
</table>

VII. Suggested Text
VII. Bibliography


**Course Action Request**

**University of Alaska Anchorage**

Proposal to Initiate, Add, Change, or Delete a Course

<table>
<thead>
<tr>
<th>1a. School or College</th>
<th>1b. Division</th>
<th>1c. Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS CAS</td>
<td>AMSC Division of Math Science</td>
<td>Geological Sciences</td>
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</table>

<table>
<thead>
<tr>
<th>2. Course Prefix</th>
<th>3. Course Number</th>
<th>4. Previous Course Prefix &amp; Number</th>
<th>5a. Credits/CEUs</th>
<th>5b. Contact Hours (Lecture + Lab)</th>
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<tbody>
<tr>
<td>GEOL</td>
<td>A636</td>
<td>n/a</td>
<td>3</td>
<td>(3+0)</td>
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<table>
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<th>6. Complete Course Title</th>
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<tr>
<td>Petroleum Geology</td>
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Abbreviated Title for Transcript (30 character)

<table>
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<th>7. Type of Course</th>
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<tr>
<td>☑ Academic</td>
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<td>☐ Preparatory/Development</td>
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<tr>
<td>☐ Non-credit</td>
</tr>
<tr>
<td>☐ CEU</td>
</tr>
<tr>
<td>☐ Professional Development</td>
</tr>
</tbody>
</table>

| 8. Type of Action: | ☑ Add | ☐ Change | ☐ Delete |

If a change, mark appropriate boxes:

- Prefix
- Credits
- Title
- Grading Basis
- Course Description
- Test Score Prerequisites
- Automatic Restrictions
- Class Level
- Other CCG (please specify)

<table>
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<th>9. Repeat Status No</th>
<th># of Repeats</th>
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<th>10. Grading Basis</th>
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<td>☑ A-F</td>
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<tr>
<td>☐ P/NP</td>
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<table>
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<tr>
<th>11. Implementation Date</th>
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<tr>
<td>From: Spring/2016</td>
</tr>
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<td>To: /9999</td>
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<th>12. Cross Listed with</th>
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<tr>
<td>☐ A436</td>
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Cross-Listed Coordination Signature

<table>
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<tr>
<th>13a. Impacted Courses or Programs:</th>
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<tbody>
<tr>
<td>List any programs or college requirements that require this course.</td>
</tr>
</tbody>
</table>

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<tr>
<th>Impacted Program/Course</th>
<th>Date of Coordination</th>
<th>Chair/Coordinator Contacted</th>
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<tr>
<td>1. Geological Sciences</td>
<td>3/1/2015</td>
<td>K. Crossen</td>
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Initiator Name (typed): **Jennifer Aschoff**

Initiator Signed Initials: __________ Date: __________

<table>
<thead>
<tr>
<th>13b. Coordination Email</th>
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<tbody>
<tr>
<td>Date: __________</td>
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submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)

<table>
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<th>13c. Coordination with Library Liaison</th>
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<table>
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<tr>
<th>14. General Education Requirement</th>
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<tbody>
<tr>
<td>Mark appropriate box:</td>
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<tr>
<td>☐ Oral Communication</td>
</tr>
<tr>
<td>☐ Written Communication</td>
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<tr>
<td>☐ Quantitative Skills</td>
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<tr>
<td>☐ Humanities</td>
</tr>
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<tr>
<td>☐ Natural Sciences</td>
</tr>
<tr>
<td>☐ Integrative Capstone</td>
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<table>
<thead>
<tr>
<th>15. Course Description (suggested length 20 to 50 words)</th>
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<tbody>
<tr>
<td>Introduction to the formation of hydrocarbons, their migration/accumulation in the context of the petroleum system, and their exploration/exploitation. Includes an introduction to subsurface datasets used in the petroleum industry and how to integrate them. Conventional and unconventional petroleum systems are discussed in the class using examples from Alaska and around the world.</td>
</tr>
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<table>
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<tr>
<th>16a. Course Prerequisite(s) (list prefix and number or test code and score)</th>
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<th>16b. Co-requisite(s) (concurrent enrollment required)</th>
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<th>16c. Automatic Restriction(s)</th>
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<tr>
<td>☐ College</td>
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<tr>
<td>☐ Major</td>
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<td>☐ Class</td>
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<tr>
<td>☑ Level</td>
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<table>
<thead>
<tr>
<th>16d. Registration Restriction(s) (non-codable)</th>
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<tbody>
<tr>
<td>Graduate Standing</td>
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| 17. ☑ Mark if course has fees |

| 18. ☐ Mark if course is a selected topic course |

<table>
<thead>
<tr>
<th>19. Justification for Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adding introductory course in Petroleum Geology based on student demand</td>
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Initiator (faculty only) **Jennifer Aschoff**

Initiator (TYPE NAME)

<table>
<thead>
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<th>Approved</th>
<th>Disapproved</th>
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Initiator Date

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Department Chair Date

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Undergraduate/Graduate Academic Board Chair

<table>
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<tr>
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Provost or Designee Date

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<tr>
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<th>Disapproved</th>
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<tbody>
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<td>☐</td>
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</table>

College/School Curriculum Committee Chair Date
I. **Date of Initiation:** Spring 2015

II. **Course Information**
   A. College: CAS  
   B. Course Subject: Geological Sciences  
   C. Course Number: GEOL A636  
   D. Number of Credits: 3.0 (3+0)  
   E. Course Title: Petroleum Geology  
   F. Grading Basis: A-F  
   G. Course Description: Introduction to the formation of hydrocarbons, their migration/accumulation in the context of the petroleum system, and their exploration/exploitation. Includes an introduction to subsurface datasets used in the petroleum industry and how to integrate them. Conventional and unconventional petroleum systems are discussed in the class using examples from Alaska and around the world.  
   H. Registration Restriction: Graduate Standing  
   I. Fee: Yes

III. **Instructional Goals and Student Learning Outcomes**
   A. Instructional Goals. The instructor will:  
      1. Deliver interactive, multi-media lectures, collaborative in-class exercises and laboratory exercises on the topics listed in the course description and course outline.  
      2. Incorporate real-world datasets in hands-on exercises that reflect typical tasks a geoscience professional would complete as part of their job in Petroleum Geology.  
   B. Student Learning Outcomes and Evaluation. The students will:

<table>
<thead>
<tr>
<th>Student Learning Outcomes                                                                .filtered</th>
<th>Evaluations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate understanding of the basic process of hydrocarbon accumulation formation, exploration, exploitation and valuation.</td>
<td>In-class exercises and exams</td>
</tr>
<tr>
<td>Interpret subsurface data- seismic, well-log and core with a focus on key information needed to determine the presence, effectiveness and/or timing of various petroleum systems elements.</td>
<td>In-class exercises and exams</td>
</tr>
<tr>
<td>Associates and articulates the elements of the petroleum system as they pertain to their core discipline in the form of an integrative research project.</td>
<td>Final Research Project</td>
</tr>
</tbody>
</table>
Synthesize and articulate the mechanics of the petroleum system and its constituent elements: source, reservoir, seal, trap and migration pathway.

IV. Course Evaluations
Based on grades received on exercises, exams, and in-class participation.

V. Course Level Justification
This course provides students with fundamental skills in petroleum geology. It is typically taught as an upper-level undergraduate (400) or graduate course (600) at other institutions. The class is stacked with a 400-level (Geol 436) for undergraduate students. The 600-level course requires a rigorous, individual research project where students generate and interpret a dataset that applies two or more course concepts.

VI. Topical Course Outline

A. Reserves vs Resources
   1. World Energy Reserves
   2. Reserves Concept
   3. Reserves Calculation (OOIP and OGIP)
   5. Geologic and Engineering Controls on Recovery Factors
   6. Petroleum System Overview
   7. Unconventional vs Conventional Systems

B. Hydrocarbon Generation and Source Rocks
   1. Kerogen and Kerogen Types
   2. Measuring Source Rock Quality: Pyrolysis, TOC, HI, S1, S2, S3
   3. Controls on Source Rock Quality
   4. Burial and Thermal Maturation
   5. Geothermal Gradients and Basin Type

C. Hydrocarbon Migration
   1. Carrier Beds and Migration Pathways
   2. Using Structure Maps to Understand Migration (“Spider Maps”)
   3. Review Contouring Structure Maps
   4. Fill-Spill, Fill-Leak
   5. Primary vs Secondary Migration
   6. Gas, Oil, Water Contacts

D. Subsurface Data Interpretation
   1. Seismic Data Acquisition
   2. Distinguishing Noise in Seismic
3. Seismic Interpretation
4. Well-log Acquisition
5. Well-log Interpretation

E. Reservoirs
   1. Review Porosity and Permeability
   2. Primary vs. Secondary Porosity
   3. Depositional Environment Controls on Porosity and Permeability
   4. Diagenetic Controls on Porosity and Permeability
   5. Interpreting Reservoir Quality from Well-log Data
   6. Review Isopach Maps
   7. Flow Unit Concept and Defining Flow Units
   8. Concept of Reservoir Connectivity
   9. Using Decline Curves and Other Engineering Data to Interpret Reservoir Connectivity

F. Basic Well Drilling and Completion
   1. Modern Drilling and Completion Techniques
   2. Drilling/Completing Shale

VIII. Required Texts


VIII. Bibliography (*Indicates Classic Text)


# Course Action Request

**University of Alaska Anchorage**

Proposal to Initiate, Add, Change, or Delete a Course

---

### 1a. School or College
AS CAS

### 1b. Division
AMSC Division of Math Science

### 1c. Department
Geological Sciences

### 2. Course Prefix
GEOL

### 3. Course Number
A436

### 4. Previous Course Prefix & Number
n/a

### 5a. Credits/CEUs
3

### 5b. Contact Hours
(Lecture + Lab)
(3+0)

---

### 6. Complete Course Title
Survey of Petroleum Geology

**Abbreviated Title for Transcript (30 character)**

---

### 7. Type of Course

- [x] Academic
- [ ] Preparatory/Development
- [ ] Non-credit
- [ ] CEU
- [ ] Professional Development

### 8. Type of Action:

- [x] Add
- [ ] Change
- [ ] Delete

*If a change, mark appropriate boxes:*

- Prefix
- Credits
- Title
- Grading Basis
- Course Description
- Test Score Prerequisites
- Automatic Restrictions
- Class
- Level
- College
- Major
- Other CCG (please specify)

### 9. Repeat Status No  # of Repeats  Max Credits

- [x] A-F
- [ ] P/NP
- [ ] NG

### 10. Grading Basis

### 11. Implementation Date  semester/year
From: Spring/2016  To: 9999

### 12. Cross Listed with

- [x] Stacked with A636

---

### 13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at [www.uaa.alaska.edu/governance](http://www.uaa.alaska.edu/governance).

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<td>3/1/2015</td>
<td>K. Crossen</td>
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<tr>
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<td></td>
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<td>3.</td>
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</table>

Initiator Name (typed): Jennifer Aschoff  
Initiator Signed Initials: JAA  
Date: 3/1/2015

---

### 13b. Coordination Email  
submitted to Faculty Listserv: [uaa-faculty@lists.uaa.alaska.edu](mailto:uaa-faculty@lists.uaa.alaska.edu)

---

### 13c. Coordination with Library Liaison  
Date: 3/1/2015

---

### 14. General Education Requirement

Mark appropriate box:

- [ ] Oral Communication
- [x] Written Communication
- [x] Quantitative Skills
- [ ] Humanities
- [ ] Fine Arts
- [ ] Social Sciences
- [ ] Natural Sciences
- [ ] Integrative Capstone

---

### 15. Course Description (suggested length 20 to 50 words)

Formation of hydrocarbons, their migration/accumulation in the context of the petroleum system, and their exploration/exploitation. Includes an introduction to subsurface datasets used in the petroleum industry and how to integrate them. Conventional and unconventional petroleum systems are discussed in the class using examples from Alaska and around the world.

---

### 16a. Course Prerequisite(s) (list prefix and number or test code and score)

GEOL A221 with score of C or higher

### 16b. Co-requisite(s) (concurrent enrollment required)

---

### 16c. Automatic Restriction(s)

- [ ] College
- [ ] Major
- [ ] Class
- [ ] Level

### 16d. Registration Restriction(s) (non-codable)

---

### 17. Mark if course has fees

### 18. Mark if course is a selected topic course

### 19. Justification for Action

Adding new course in Petroleum Geology based on demand from students and local industry.

---

Initiator (faculty only)

Jennifer Aschoff  
Initiator (TYPE NAME)

---

Approved  
Disapproved  
Dean/Director of School/College  
Date

---

Approved  
Disapproved  
Department Chair  
Date

---

Approved  
Disapproved  
Undergraduate/Graduate Academic  
Board Chair  
Date

---

Approved  
Disapproved  
Provost or Designee  
Date

---

12
Course Content Guide  
University of Alaska Anchorage  

GEOL A436  
Survey of Petroleum Geology  

I. Date of Initiation: Spring 2015  

II. Course Information  
A. College: CAS  
B. Course Subject: Geological Sciences  
C. Course Number: GEOL A436  
D. Number of Credits: 3.0 (3+0)  
E. Course Title: Survey of Petroleum Geology  
F. Grading Basis: A-F  
G. Course Description: Formation of hydrocarbons, their migration/accumulation in the context of the petroleum system, and their exploration/exploitation. Includes an introduction to subsurface datasets used in the petroleum industry and how to integrate them. Conventional and unconventional petroleum systems are discussed in the class using examples from Alaska and around the world.  
H. Course Prerequisites: GEOL A221  
I. Fee: Yes  

III. Instructional Goals and Student Learning Outcomes  
A. Instructional Goals. The instructor will:  
   1. Deliver interactive, multi-media lectures, collaborative in-class exercises and laboratory exercises on the topics listed in the course description and course outline.  
   2. Incorporate real-world datasets in hands-on exercises that reflect typical tasks a geoscience professional would complete as part of their job in Petroleum Geology.  

B. Student Learning Outcomes and Evaluation. The students will:  

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Evaluations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate basic knowledge of the process of hydrocarbon accumulation formation, exploration, exploitation and valuation.</td>
<td>In-class exercises and exams</td>
</tr>
<tr>
<td>Interpret basic subsurface data- seismic, well-log and core with a focus on key information needed to determine the presence, effectiveness and/or timing of various petroleum systems elements.</td>
<td>In-class exercises and exams</td>
</tr>
<tr>
<td>Synthesize and articulate the mechanics of the petroleum system and its constituent elements: source, reservoir, seal, trap and migration pathway.</td>
<td>Exams</td>
</tr>
</tbody>
</table>
IV. **Course Evaluations**
Based on grades received on exercises, exams, and in-class participation.

V. **Course Level Justification**
The course will to satisfy student interest and local oil/gas industry needs in the discipline of petroleum geology.

VI. **Topical Course Outline**

A. Reserves vs Resources
   1. World Energy Reserves
   2. Reserves Concept
   3. Reserves Calculation (OOIP and OGIP)
   5. Geologic and Engineering Controls on Recovery Factors
   6. Petroleum System Overview
   8. Unconventional vs Conventional Systems

B. Hydrocarbon Generation and Source Rocks
   1. Kerogen and Kerogen Types
   2. Measuring Source Rock Quality: Pyrolysis, TOC, HI, S1, S2, S3
   3. Controls on Source Rock Quality
   4. Burial and Thermal Maturation
   5. Geothermal Gradients and Basin Type

C. Hydrocarbon Migration
   1. Carrier Beds and Migration Pathways
   2. Using Structure Maps to Understand Migration (“Spider Maps”)
   3. Review Contouring Structure Maps
   4. Fill-Spill, Fill-Leak
   5. Primary vs Secondary Migration
   6. Gas, Oil, Water Contacts

D. Subsurface Data Interpretation
   1. Seismic Data Acquisition
   2. Distinguishing Noise in Seismic
   3. Seismic Interpretation
   4. Well-log Acquisition
   5. Well-log Interpretation

E. Reservoirs
   1. Review Porosity and Permeability
   2. Primary vs. Secondary Porosity
   3. Depositional Environment Controls on Porosity and Permeability
4. Diagenetic Controls on Porosity and Permeability
5. Interpreting Reservoir Quality from Well-log Data
6. Review Isopach Maps
7. Flow Unit Concept and Defining Flow Units
8. Concept of Reservoir Connectivity
9. Using Decline Curves and Other Engineering Data to Interpret Reservoir Connectivity

F. Basic Well Drilling and Completion
   1. Modern Drilling and Completion Techniques
   2. Drilling/Completing Shale

VIII. Required Texts


VIII. Bibliography (*Indicates Classic Text)


**Course Action Request**

**University of Alaska Anchorage**

Proposal to Initiate, Add, Change, or Delete a Course

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<thead>
<tr>
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<td>A637</td>
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6. Complete Course Title

**Adv Dep Systems and Stratigraphy**

<table>
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<tr>
<th>Abbreviated Title for Transcript (30 characters)</th>
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</table>

7. Type of Course

- [X] Academic
- [ ] Preparatory/Development
- [ ] Non-credit
- [ ] CEU
- [ ] Professional Development

8. Type of Action:

- [X] Add
- [ ] Change
- [ ] Delete

If a change, mark appropriate boxes:

- [ ] Prefix
- [ ] Course Number
- [ ] Contact Hours
- [ ] Repeat Status
- [ ] Grading Basis
- [ ] Cross-Listed/Stacked
- [ ] Course Prerequisites
- [ ] Co-requisites
- [ ] Test Score Prerequisites
- [ ] Registration Restrictions
- [ ] Automatic Restrictions
- [ ] General Education Requirement
- [ ] Class
- [ ] Level
- [ ] College
- [ ] Major
- [ ] Other CCG (please specify)

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10. Grading Basis

- [X] A-F
- [ ] P/NP
- [ ] NG

11. Implementation Date

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<td>To: /9999</td>
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12. Cross Listed with

- [ ] Stacked with
- [ ] A437

13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at [www.uaa.alaska.edu/governance](http://www.uaa.alaska.edu/governance).

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Initiator Name (typed): Jennifer Aschoff

Initiator Signed Initials: __________ Date: __________

13b. Coordination Email

Date: __________

submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)

13c. Coordination with Library Liaison

Date: __________

14. General Education Requirement

Mark appropriate box:

- [ ] Oral Communication
- [ ] Written Communication
- [ ] Quantitative Skills
- [ ] Humanities
- [ ] Fine Arts
- [ ] Social Sciences
- [ ] Natural Sciences
- [ ] Integrative Capstone

15. Course Description (suggested length 20 to 50 words)

Advanced skills in sedimentary geology that can be applied in oil/gas, hydrology, and mining. Includes greater detail in depositional environments, characteristics of resultant sedimentary deposits, and sequence stratigraphy using various geologic datasets. Emphasis on hands-on application of course concepts in outcrop, core and well-log data.

16a. Course Prerequisite(s) (list prefix and number or test code and score)

16b. Co-requisite(s) (concurrent enrollment required)

16c. Automatic Restriction(s)

- [ ] College
- [ ] Major
- [ ] Class
- [ ] Level

16d. Registration Restriction(s) (non-codable)

Graduate Standing

17. [X] Mark if course has fees

18. [ ] Mark if course is a selected topic course

19. Justification for Action

Adding new, hands-on course in depositional environments and stratigraphy that emphasises data interpretation and application.

Initiator (faculty only)

Jennifer Aschoff

Initiator (TYPE NAME) 

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Date

[ ] Approved

Dean/Director of School/College

Date

[ ] Disapproved

[ ] Approved

Undergraduate/Graduate Academic

Date

[ ] Disapproved

[ ] Approved

Board Chair

Date

[ ] Disapproved

Provost or Designee

Date

17
Course Content Guide
University of Alaska Anchorage

GEOL A637
Adv Dep Systems and Stratigraphy

I. Date of Initiation: Spring 2015

II. Course Information
A. College: CAS
B. Course Subject: Geological Sciences
C. Course Number: GEOL A637
D. Number of Credits: 3.0 (2+1)
E. Course Title: Adv Dep Systems and Stratigraphy
F. Grading Basis: A-F
G. Course Description: Advanced skills in sedimentary geology that can be applied in oil/gas, hydrology, and mining, and expose students to subsurface datasets. Includes the many environments in which sediment is deposited, characteristics of resultant sedimentary deposits, and the range of methods to interpret and correlate sedimentary deposits using various geologic datasets. Emphasis on hands-on core and well-log interpretation.
H. Registration Restrictions: Graduate Standing
I. Fee: Yes

III. Instructional Goals and Student Learning Outcomes
A. Instructional Goals. The instructor will:
   1. Deliver interactive, multi-media lectures, collaborative in-class exercises and laboratory exercises on the topics listed in the course description and course outline.
   2. Incorporate real-world datasets in hands-on exercises that reflect typical tasks a geoscience professional would complete as part of their job.

B. Student Learning Outcomes and Evaluation. The students will:

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<td>Describe and interpret paleohydraulic conditions from complex sedimentary structures and fabrics using outcrop and rock core.</td>
<td>Exercises</td>
</tr>
<tr>
<td>Interpret depositional environments from stratigraphic architectures, sedimentary structures/fabrics in outcrop and rock core.</td>
<td>Exercises and Exam(s)</td>
</tr>
<tr>
<td>Correlate well-logs and outcrop sections using sequence-stratigraphic methods.</td>
<td>Collaborative In-class Exercises</td>
</tr>
<tr>
<td>Synthesize course concepts and integrate a range of subsurface data to deduce the depositional history</td>
<td>Exercises and Final Project</td>
</tr>
<tr>
<td>Articulate scientific interpretations to specialists.</td>
<td>Final Presentation</td>
</tr>
</tbody>
</table>
IV. Course Evaluations
Based on grades received on in-class exercises, laboratory exercises, exam(s) and presentations.

V. Course Level Justification
This course provides students with advanced skills in stratigraphy to make interpretations of complex sedimentary successions and application of sequence stratigraphy. It is typically taught as an upper-level undergraduate (400) or graduate course (600) at other institutions. The class is stacked with a 400-level (Geol A437) for undergraduate students. The 600-level course requires a rigorous, individual research project where students generate and interpret a dataset that applies two or more course concepts.

VI. Topical Course Outline

A. Depositional System Concept
   1. Sedimentary Process and Product
   2. Facies Definition
   3. Facies Paleohydraulic Interpretation- Flow Regime Concept
   4. Depositional Environment vs. Depositional System
   5. Overview of Depositional Environments
   6. Modern Depositional Systems

B. Outcrop Interpretation
   1. Architectural Analysis in Fluvial-Lacustrine Outcrop
   2. Facies Definition and Interpretation in Outcrop

C. Depositional Environments in a Clastic Shelf to Slope System
   1. Shelfal: Regressive Marginal Marine
   2. Shelfal: Transgressive Marginal Marine
   3. Slope
   4. Basin floor and Offshore Mudstone
   8. Source-to-Sink Connection of Depositional Environments within a System

D. Depositional Environments in a Carbonate Platform System
   1. Platform Carbonates
   2. Reef Depositional Models

E. Sequence Stratigraphy
   1. Comparison of Sequence Stratigraphy to Lithostratigraphy
   2. Terminology
   3. Walther’s Law
   4. History and Development from Seismic Stratigraphy
   5. Overview of Seismic and Well-log Data
   6. Application of Sequence Stratigraphy in Seismic Data
   7. Application of Sequence Stratigraphy in Outcrop Data
8. Application of Sequence Stratigraphy in Well-log Data

F. Core Description
   1. Drilling Wells and Taking Core
   2. Defining Intervals to be Cored
   3. Types of Core
   4. Proper Handling and Care of Core
   5. Core Description and Presentation of Core Data

G. Presenting Core Data
   1. Creating a Poster to Display Scientific Data
   2. Articulating Scientific Interpretations to Broad Audiences

VIII. Required Text


VIII. Bibliography (*Indicates Classic Text)


*Mitchum, R. M., 1977, Seismic Stratigraphy and Global Changes of Sea Level, Part 2: The Depositional sequence as a basic unit for stratigraphic


Schlager, W., 2005, Carbonate Sedimentology and Sequence Stratigraphy; SEPM Concepts in Sedimentology and Paleontology #8, 200 p.


**Course Action Request**  
**University of Alaska Anchorage**  
Proposal to Initiate, Add, Change, or Delete a Course

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<table>
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<tr>
<th>6. Complete Course Title</th>
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<tbody>
<tr>
<td>Dep Systems and Dynamic Strat</td>
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<th>8. Type of Action: Add</th>
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If a change, mark appropriate boxes:
- Prefix
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- Title
- Grading Basis
- Course Description
- Test Score Prerequisites
- Automatic Restrictions
- Class
- Level
- College
- Major
- Other CCG (please specify)

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<th>10. Grading Basis</th>
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<tbody>
<tr>
<td>☑ A-F</td>
<td>semester/year</td>
</tr>
<tr>
<td></td>
<td>From: Fall/2016</td>
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<tr>
<th>12. Cross Listed with</th>
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Cross-Listed Coordination Signature: ________________________

13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at www.uaa.alaska.edu/governance.

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Initiator Name (typed): Jennifer Aschoff  
Initiator Signed Initials: __________  
Date: __________

13b. Coordination Email: Date: _____  
submitted to Faculty Listserv: uaa-faculty@lists.uaa.alaska.edu

13c. Coordination with Library Liaison: Date: _____

14. General Education Requirement: Mark appropriate box:
- Oral Communication
- Written Communication
- Quantitative Skills
- Humanities
- Fine Arts
- Social Sciences
- Natural Sciences
- Integrative Capstone

15. Course Description (suggested length 20 to 50 words)

Advanced skills in sedimentary geology that can be applied in oil/gas, hydrology, and mining. Includes greater detail in depositional environments, characteristics of resultant sedimentary deposits, and sequence stratigraphy using various geologic datasets. Emphasis on hands-on application of course concepts in outcrop, core and well-log data.

16a. Course Prerequisite(s) (list prefix and number or test code and score)

GEOL A221 with score of “C” or higher

16b. Co-requisite(s) (concurrent enrollment required)

16c. Automatic Restriction(s)

- College
- Major
- Class
- Level

16d. Registration Restriction(s) (non-codable)

Mark if course is a selected topic course

17. ☑ Mark if course has fees

18. ☑ Mark if course is a selected topic course

19. Justification for Action

Adding new, hands-on course in depositional environments and stratigraphy that emphasises data interpretation and application.

Initiator (faculty only): Jennifer Aschoff  
Initiator (TYPE NAME): ________________________  
Date: __________

☑ Approved  
Disapproved  
Dean/Director of School/College  
Date: __________

☑ Approved  
Disapproved  
Undergraduate/Graduate Academic  
Date: __________

☑ Approved  
Disapproved  
Board Chair  
Date: __________

☑ Approved  
Disapproved  
Provost or Designee  
Date: __________
Course Content Guide  
University of Alaska Anchorage  

GEOL A437  
Dep Systems and Dynamic Strat  

I. Date of Initiation: Spring 2015  

II. Course Information  
A. College: CAS  
B. Course Subject: Geological Sciences  
C. Course Number: GEOL A437  
D. Number of Credits: 3.0 (2+1)  
E. Course Title: Dep Systems and Dynamic Strat  
F. Grading Basis: A-F  
G. Course Description: Advanced skills in sedimentary geology that can be applied in oil/gas, hydrology, and mining, and expose students to subsurface datasets. Includes the many environments in which sediment is deposited, characteristics of resultant sedimentary deposits, and the range of methods to interpret and correlate sedimentary deposits using various geologic datasets. Emphasis on hands-on core and well-log interpretation.  
H. Course Prerequisites: GEOL A221 with grade of “C” or higher  
A. Fee: Yes  

III. Instructional Goals and Student Learning Outcomes  
A. Instructional Goals. The instructor will:  
   1. Deliver interactive, multi-media lectures, collaborative in-class exercises and laboratory exercises on the topics listed in the course description and course outline.  
   2. Incorporate real-world datasets in hands-on exercises that reflect typical tasks a geoscience professional would complete as part of their job.  
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</table>
IV. Course Evaluations
Based on grades received on in-class exercises, laboratory exercises, exam(s) and presentations.

V. Course Level Justification
This course builds on Historical Geology (Geol 221) by providing students with more advanced skills to make interpretations of complex sedimentary successions. Additionally, the course complements concepts in Sedimentology (Geol 430) and Stratigraphy (Geol 432) by enhancing student skills in sedimentology, while providing new skills in sequence stratigraphy, rock core description, outcrop description and subsurface data interpretation. It is typically taught as an upper-level undergraduate (400) or graduate course (600) at other institutions. The class is stacked with a 600-level (Geol 637) for graduate students.

VI. Topical Course Outline

A. Depositional System Concept
   1. Sedimentary Process and Product
   2. Facies Definition
   3. Facies Paleohydraulic Interpretation - Flow Regime Concept
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G. Presenting Core Data
1. Creating a Poster to Display Scientific Data
2. Articulating Scientific Interpretations to Broad Audiences

VIII. Required Text

ISBN 0444515682

VIII. Bibliography (*Indicates Classic Text)


Schlager, W., 2005, Carbonate Sedimentology and Sequence Stratigraphy; SEPM Concepts in Sedimentology and Paleontology #8, 200 p.


# Course Action Request
## University of Alaska Anchorage
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<th>6. Complete Course Title</th>
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<tr>
<td>Adv Sed Petrology and Diagenesis</td>
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If a change, mark appropriate boxes:
- Prefix
- Credits
- Title
- Grading Basis
- Course Description
- Test Score Prerequisites
- Automatic Restrictions
- Class Level
- College Major
- Other CCG (please specify)

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Cross-Listed Coordination Signature

13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at www.uaa.alaska.edu/governance.

<table>
<thead>
<tr>
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Initiator Name (typed): Jennifer Aschoff

Initiator Signed Initials: _______ Date: ___________

13b. Coordination Email

submitted to Faculty Listserv: uae-faculty@lists.uaa.alaska.edu

13c. Coordination with Library Liaison

Date: ___________

14. General Education Requirement

Mark appropriate box:
- Oral Communication
- Written Communication
- Quantitative Skills
- Humanities
- Fine Arts
- Social Sciences
- Natural Sciences
- Integrative Capstone

15. Course Description (suggested length 20 to 50 words)

Advanced concepts in sedimentary petrography and petrology, including diagenesis. Topics include advanced rock classification, grain identification in thin section, cement identification, sedimentary fabric, paragenetic sequence and provenance analysis, and porosity estimation in carbonate and clastic sedimentary rocks. Emphasis on hands-on description, interpretation and applications.

16a. Course Prerequisite(s) (list prefix and number or test code and score)

16b. Co-requisite(s) (concurrent enrollment required)

16c. Automatic Restriction(s)

- College
- Major
- Class
- Level

16d. Registration Restriction(s) (non-codable)

Graduate Standing

17. ✘ Mark if course has fees

18. □ Mark if course is a selected topic course

19. Justification for Action

Adding advanced course in advanced sedimentary petrology based on student interest and needs

Initiator (faculty only)

Jennifer Aschoff

Initiator (TYPE NAME)

Date

Approved

Disapproved

Dean/Director of School/College

Date

Approved

Undergraduate/Graduate Academic

Date

Approved

Board Chair

Date

Approved

Provost or Designee

Date
I. Date of Initiation: Spring 2015

II. Course Information
A. College: CAS
B. Course Subject: Geological Sciences
C. Course Number: GEOL A638
D. Number of Credits: 3.0 (2+1)
E. Course Title: Adv Sed Petrology and Diagenesis
F. Grading Basis: A-F
G. Course Description: Advanced concepts in sedimentary petrography and petrology, including diagenesis. Topics include advanced rock classification, grain identification in thin section, cement identification, sedimentary fabric, paragenetic sequence and provenance analysis, and porosity estimation in carbonate and clastic sedimentary rocks. Emphasis on hands-on description, interpretation and applications.
H. Registration Restriction: Graduate Standing
A. Fee: Yes

III. Instructional Goals and Student Learning Outcomes
A. Instructional Goals. The instructor will:
   1. Deliver interactive, multi-media lectures, collaborative in-class exercises and laboratory exercises on the topics listed in the course description and course outline.
   2. Incorporate real-world datasets in hands-on exercises that reflect typical tasks a geoscience professional would complete as part of their job.

B. Student Learning Outcomes and Evaluation. The students will:

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Evaluations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify, describe and interpret sedimentary grains in thin-section.</td>
<td>Exercises</td>
</tr>
<tr>
<td>Interpret depositional environments and provenance from thin section.</td>
<td>Exercises and</td>
</tr>
<tr>
<td></td>
<td>Exam(s)</td>
</tr>
<tr>
<td>Determine and classify various types of porosity, and delineate paragenetic sequences.</td>
<td>Exercises and</td>
</tr>
<tr>
<td></td>
<td>exams</td>
</tr>
<tr>
<td>Point count and interpret sedimentary provenance from point-count data.</td>
<td>Exercises</td>
</tr>
<tr>
<td>Generating, integrating, interpreting, synthesizing and presenting data.</td>
<td>Final Project</td>
</tr>
</tbody>
</table>
IV. Course Evaluations
Based on grades received on in-class exercises, laboratory exercises, exam(s) and presentations.

V. Course Level Justification
This course builds on concepts presented in Sedimentology (Geol A430), Stratigraphy (Geol A431) by enhancing student skills in sedimentology, while providing new skills in thin-section inspection and advanced sedimentary petrology. It is typically taught as an upper-level undergraduate (400) or graduate course (600) at other institutions. The class is stacked with a 400-level (Geol A438) for graduate students. Students enrolled in the 600-level course will be required to generate and interpret data related to the course content.

VI. Topical Course Outline

A. Review of Microscopes and Optical Mineralogy
   1. Optics
   2. Identification of Sedimentary Grain Types
   3. Components of Sedimentary Rocks
   4. Common Applications of Sedimentary Petrology

B. Framework Composition and Classification of Sandstone
   1. Common Sandstone Types
   2. Provenance Analysis
   3. Point Counting

C. Cements and Diagenesis of Sandstone
   1. Physical Diagenesis/Compaction
   2. Compaction Textures and Their Interpretation
   3. Cement Types and Their Identification
   4. Chemical Diagenesis- Cementation, Paragenesis and Authigenesis
   3. Porosity Measurement from Thin Section
   4. Porosity Classification

D. Composition and Classification of Shale
   1. Grain Types
   2. Mud Sedimentation

E. Composition and Classification of Carbonate Rocks
   1. Identification and Interpretation of Carbonate Grain-types
   2. Classification Schemes for Carbonates
   3. Identifying Fossils in Thin-section
   4. Interpretation of Carbonate Fabrics in Thin-section

F. Diagenesis of Carbonate Rocks
   1. Various Calcite Forms and Their Identification in Thin-section
2. Dolomitization
3. Interpreting Degrees of Dolomitization
4. Paragenetic Sequence Analysis in Carbonate Rocks

VIII. Required Text


VIII. Bibliography (*Indicates Classic Text)


*Ingersoll, R.V. and Suczek, C.A., 1979, Perology and provenance of Neogene sand from Nicobar and Bengal fans, DSDP sites 211 and 218: Journal of Sedimentary Petrology, v. 49, p. 1217-1228.


### 1. School or College
AS CAS

### 2. Course Prefix
GEOL

### 3. Course Number
A438

### 4. Previous Course Prefix & Number
n/a

### 5. Credits/CEUs
3

### 6. Complete Course Title
Advanced Sedimentary Petrology

### 7. Type of Course
- [x] Academic
- [ ] Preparatory/Development
- [ ] Non-credit
- [ ] CEU
- [ ] Professional Development

### 8. Type of Action:
- [x] Add
- [ ] Change
- [ ] Delete

#### If a change, mark appropriate boxes:
- [ ] Prefix
- [ ] Credits
- [ ] Grade
- [ ] Title
- [ ] Grading Basis
- [ ] Contact Hours
- [ ] Course Description
- [ ] Test Score Prerequisites
- [ ] Automatic Restrictions
- [ ] Class
- [ ] Level
- [ ] College
- [ ] Major
- [ ] Other CCG (please specify)

### 9. Repeat Status No
- [ ] # of Repeats
- [ ] Max Credits

### 10. Grading Basis
- [x] A-F
- [ ] P/NP
- [ ] NG

### 11. Implementation Date
- [ ] semester/year
From: Fall/2016
To: /9999

### 12. Cross Listed with
- [ ] Stack with 638

### 13a. Impacted Courses or Programs:
- List any programs or college requirements that require this course.

### 13b. Coordination Email
- [ ] Date: submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)

### 14. General Education Requirement
- [ ] Oral Communication
- [ ] Written Communication
- [ ] Quantitative Skills
- [ ] Fine Arts
- [ ] Social Sciences
- [ ] Natural Sciences
- [ ] Integrative Capstone

### 15. Course Description (suggested length 20 to 50 words)
Advanced concepts in sedimentary petrography and petrology, including a survey of diagenesis. Topics include advanced rock classification, grain identification in thin section, cement identification, sedimentary fabric, paragenetic sequence and provenance analysis, and porosity estimation in carbonate and clastic sedimentary rocks. Emphasis on hands-on description, interpretation and applications.

### 16a. Course Prerequisite(s) (list prefix and number or test code and score)
- GEOL A431 with score of C or higher
- GEOL A321 with score of C or higher

### 16b. Co-requisite(s) (concurrent enrollment required)

### 16c. Automatic Restriction(s)
- [ ] College
- [ ] Major
- [ ] Class
- [ ] Level

### 16d. Registration Restriction(s) (non-codable)

### 17. Mark if course has fees

### 18. Mark if course is a selected topic course

### 19. Justification for Action
Adding advanced course in advanced sedimentary petrology based on student interest and needs

---

**Initiator (faculty only) **
Jennifer Aschoff
Initiator Signed Initials: ________ Date: __________

**Initiator (TYPE NAME) **

**Dean/Director of School/College **
Approved
Disapproved
Date

**Undergraduate/Graduate Academic **
Approved
Disapproved
Date

**Provost or Designee **
Approved
Disapproved
Date
Course Content Guide
University of Alaska Anchorage

GEOL A438
Advanced Sedimentary Petrology and Diagenesis

I. Date of Initiation: Spring 2015

II. Course Information
A. College: CAS
B. Course Subject: Geological Sciences
C. Course Number: GEOL A438
D. Number of Credits: 3.0 (2+1)
E. Course Title: Advanced Sedimentary Petrology and Diagenesis
F. Grading Basis: A-F
G. Course Description: Advanced concepts in sedimentary petrography and petrology, including a survey of diagenesis. Topics include advanced rock classification, grain identification in thin section, cement identification, sedimentary fabric, paragenetic sequence and provenance analysis, and porosity estimation in carbonate and clastic sedimentary rocks. Emphasis on hands-on description, interpretation and applications.
H. Course Prerequisites: GEOL A331 with score of “C” or higher and GEOL A321 with score of “C” or higher

III. Instructional Goals and Student Learning Outcomes
A. Instructional Goals. The instructor will:
1. Deliver interactive, multi-media lectures, collaborative in-class exercises and laboratory exercises on the topics listed in the course description and course outline.
2. Incorporate real-world datasets in hands-on exercises that reflect typical tasks a geoscience professional would complete as part of their job.

B. Student Learning Outcomes and Evaluation. The students will:

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<th>Student Learning Outcomes</th>
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<td>Identify, describe and interpret sedimentary grains in thin-section</td>
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<tr>
<td>interpret depositional environments and provenance from thin section</td>
<td>Exercises and Exam(s)</td>
</tr>
<tr>
<td>Determine and classify various types of porosity, and delineate paragenetic sequences</td>
<td>Exercises and exams</td>
</tr>
<tr>
<td>Point count and interpret sedimentary provenance from point-count data</td>
<td>Exercises</td>
</tr>
</tbody>
</table>
IV. Course Evaluations
   Based on grades received on in-class exercises, laboratory exercises, exam(s) and presentations.

V. Course Level Justification
   This course builds on concepts presented in Sedimentology (Geol 430), Stratigraphy (Geol A431) by enhancing student skills in sedimentology, while providing new skills in thin-section inspection and advanced sedimentary petrology. It is typically taught as an upper-level undergraduate (400) or graduate course (600) at other institutions. The class is stacked with a 600-level (Geol A638) for graduate students.

VI. Topical Course Outline
   A. Review of Microscopes and Optical Mineralogy
      1. Optics
      2. Identification of Sedimentary Grain Types
      3. Components of Sedimentary Rocks
      4. Common Applications of Sedimentary Petrology

   B. Framework Composition and Classification of Sandstone
      1. Common Sandstone Types
      2. Provenance Analysis
      3. Point Counting

   C. Cements and Diagenesis of Sandstone
      1. Physical Diagenesis/Compaction
      2. Compaction Textures and Their Interpretation
      3. Cement Types and Their Identification
      4. Chemical Diagenesis- Cementation, Paragenesis and Authigenesis
      3. Porosity Measurement from Thin Section
      4. Porosity Classification

   D. Composition and Classification of Shale
      1. Grain Types
      2. Mud Sedimentation

   E. Composition and Classification of Carbonate Rocks
      1. Identification and Interpretation of Carbonate Grain-types
      2. Classification Schemes for Carbonates
      3. Identifying Fossils in Thin-section
      4. Interpretation of Carbonate Fabrics in Thin-section

   F. Diagenesis of Carbonate Rocks
      1. Various Calcite Forms and Their Identification in Thin-section
      2. Dolomitization
3. Interpreting Degrees of Dolomitization  
4. Paragenetic Sequence Analysis in Carbonate Rocks

VIII. Required Text


VIII. Bibliography (*Indicates Classic Text)


   *Ingersoll, R.V. and Suczek, C.A., 1979, Perology and provenance of Neogene sand from Nicobar and Bengal fans, DSDP sites 211 and 218: Journal of Sedimentary Petrology, v. 49, p. 1217-1228.


Course Action Request
University of Alaska Anchorage
Proposal to Initiate, Add, Change, or Delete a Course

1a. School or College
AS CAS

1b. Division
AMSC Division of Math Science

1c. Department
Geological Sciences

2. Course Prefix
GEOL

3. Course Number
A640

4. Previous Course Prefix & Number
N/A

5a. Credits/CEUs
4

5b. Contact Hours (Lecture + Lab)
(3+1)

6. Complete Course Title
Advanced Hydrogeology

Abbreviated Title for Transcript (30 characters)

7. Type of Course
☒ Academic ☐ Preparatory/Development ☐ Non-credit ☐ CEU ☐ Professional Development

8. Type of Action: ☒ Add or ☐ Change or ☐ Delete

If a change, mark appropriate boxes:

☒ Prefix ☐ Credits ☐ Grade Basis ☐ Course Number ☐ Contact Hours ☐ Title ☐ Repeat Status
☒ Grading Basis ☐ Cross-Listed/Stacked ☐ Course Description ☐ Course Prerequisites ☐ Test Score Prerequisites ☐ Co-requisites
☒ Automatic Restrictions ☐ Registration Restrictions ☐ Class ☐ Level ☐ College ☐ Major ☐ General Education Requirement
☒ Other CCG (please specify)

9. Repeat Status No # of Repeats Max Credits

10. Grading Basis ☒ A-F ☐ P/NP ☐ NG

11. Implementation Date semester/year
From: Spring/2016 To: /9999

12. ☐ Cross Listed with
Cross Listed with GEOL A440

13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at www.uaa.alaska.edu/governance.

<table>
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<td>2. AEST - COE, M.S.</td>
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Initiator Name (typed): Donald M. Reeves Initiator Signed Initials: _________ Date:________________

13b. Coordination Email Date: 4/3/15
submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)

13c. Coordination with Library Liaison Date: 4/3/15

14. General Education Requirement
Mark appropriate box:
☑ Oral Communication ☐ Written Communication ☐ Quantitative Skills ☐ Humanities
☐ Fine Arts ☐ Social Sciences ☐ Natural Sciences ☐ Integrative Capstone

15. Course Description (suggested length 20 to 50 words)
Comprehensive coverage of the fundamentals of Hydrogeology including physical and hydraulic properties of subsurface aquifers, Darcy’s Law and the Ground Water Flow Equation, hydraulic head, storage and effective stress, regional ground water flow, aquifer hydraulics, and water well design and development. Laboratory time will be used to enhance data analysis, mathematical, and problem-solving skill sets.

16a. Course Prerequisite(s) (list prefix and number or test code and score)

16b. Co-requisite(s) (concurrent enrollment required)

16c. Automatic Restriction(s)
☐ College ☐ Major ☐ Class ☒ Level

16d. Registration Restriction(s) (non-codable)
Graduate standing

17. ☒ Mark if course has fees

18. ☐ Mark if course is a selected topic course

19. Justification for Action
Graduate level course to be stacked with GEOL A440.

Initiator (faculty only)

Donald M. Reeves Initiator (TYPE NAME)

[Approval or Disapproval boxes for Initiator, Dean/Director of School/College, Department Chair, Undergraduate/Graduate Academic Board Chair, Provost or Designee]
Course Content Guide  
University of Alaska Anchorage  

GEOL A640  
Advanced Hydrogeology  

I. Date of Initiation: Spring 2016  

II. Course Information  
A. College: CAS  
B. Course Subject: Geological Sciences  
C. Course Number: GEOL A640  
D. Number of Credits: 4.0 (3+1)  
E. Course Title: Hydrogeology  
F. Grading Basis: A-F  
G. Course Description: Comprehensive coverage of the fundamentals of Hydrogeology including physical and hydraulic properties of subsurface aquifers, Darcy’s Law and the Ground Water Flow Equation, hydraulic head, storage and effective stress, regional ground water flow, aquifer hydraulics, and water well design and development. Laboratory time will be used as a recitation to enhance data analysis, mathematical, and problem-solving skill sets.  
H. Course Prerequisites:  
I. Fee: Yes  

III. Instructional Goals and Student Learning Outcomes  
A. Instructional Goals. The instructor will:  
1. Provide interactive PowerPoint lectures on the topics listed in the course description and course outline. These topics represent the theoretical and applied foundation of Hydrogeology.  
2. Use laboratory time to facilitate the development and enhancement of students’ data analysis, mathematical, and problem-solving skill sets.  
3. Incorporate real-world hydrogeologic applications through an Anchorage Hydrogeology field trip, incorporation of actual hydrogeologic data in problem sets, and discussion of selected book highlighting real-world problem(s).  
4. An additional and more rigorous set of graduate-level problems will be provided for all graduate students. These problem sets are designed to provide the graduate students with a higher level of understanding in the course subject matter.  

B. Student Learning Outcomes and Evaluation. The students will:  

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Evaluations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquire a solid understanding of the fundamental processes and theory used in hydrogeology.</td>
<td>Problem sets and exams.</td>
</tr>
<tr>
<td>Demonstrate and articulate understanding of real-</td>
<td>Problem sets and selected text</td>
</tr>
</tbody>
</table>
world hydrogeologic problems and applications. discussion.

<table>
<thead>
<tr>
<th>Enhance existing data analysis, mathematical, and problem-solving skill sets.</th>
<th>Problem sets and exams.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate professional level understanding of hydrogeologic concepts.</td>
<td>Rigorous, professional-level problem sets and exams.</td>
</tr>
</tbody>
</table>

### IV. Course Evaluations
Based on grades received on problem sets, exams, and attendance during book discussion and field trip. Graduate students enrolled in 640 will receive graduate-level problem sets that will incur an estimated 2-4 hours of additional work per problem set.

### V. Course Level Justification
This course provides the necessary theoretical and applied foundations of hydrogeology, and is typically taught at the 400- and graduate-levels (often stacked) in the vast majority of Universities, both domestic and abroad.

The primary difference between A440 and A640 is that A640 students will receive graduate-level problem sets. These additional exercises will be significantly more difficult and challenging than the problem sets required by the A440 students. Exams will also differ between A440 and A640 students. This approach is commonly used to distinguish between undergraduate and graduate course loads for stacked courses.

### VI. Topical Course Outline

A. Introduction to Hydrogeology
   1. Basic Concepts and Processes
   2. Worldwide Distribution of Water
   3. Highlighted Hydrogeology Applications

B. Properties of Aquifers
   1. Porosity and Porosity Computation
   2. Permeability
   3. Darcy’s Law
   4. Permeability Estimation for Unconsolidated Materials
   5. Basic Aquifer Concepts

C. Principles of Ground Water Flow
   1. Fluid Energy and Hydraulic Head
   2. Bernoulli Equation and Hubbert Force Potential
   3. Fluid Density and Viscosity
   4. Specific Discharge and Ground Water Velocity
   5. Laminar and Turbulent Flow Regimes

D. Ground Water Flow Equations
1. Homogeneity/Heterogeneity and Isotropy/Anisotropy
2. Gradient Operator and Partial Derivatives
4. Overburden and Effective Stress
5. Aquifer Storage and Compaction
6. Solutions to the Groundwater Flow Equation for Confined and Unconfined Aquifers
7. Capillarity

E. Regional Ground Water Flow Equations
   1. Zones of Recharge and Discharge
   2. Hubbert and Toth Models of Regional Flow
   3. Permeability Contrasts and Flow Barriers
   4. Ground Water – Surface Water Interaction
   5. Field Water Balances
   6. Hyporheic Zone Exchange

F. Geology and Ground Water Occurrence
   1. Unconsolidated Aquifers
   2. Consolidated Aquifers
   3. Tectonic Settings
   4. Coastal Aquifers and Tidal Influences

G. Water Wells
   1. Well Drilling
   2. Well Screens and Sediment Size Analysis
   3. Water Well Design
   4. Water Well Development
   5. Water Well Pumps

H. Estimation of Aquifer Parameters
   1. Stratigraphic Unit and Hydrostratigraphic Unit Designation
   2. Arithmetic, Geometric, and Harmonic Averaging and Averaging Rules
   3. Permeameters and Core Estimation of K
   4. Well Hydraulics: Pumping and Slug Tests
   5. Estimation of Hydraulic Properties from Pumping and Slug Tests
   6. Well Interference and Hydrogeologic Boundaries

I. Additional Reading (Either Ogalla Blue or Cadillac Desert)
   1. Highlight real-world problems identified in selected book and discuss potential solutions.
   2. Extrapolate real-world problems identified in book to other hydrogeologic settings.

VIII. Required Texts

Selected Book on Real-World Problem, e.g., Cadillac Desert and Ogalla Blue in Bibliography (subject to change).

VIII. Bibliography


<table>
<thead>
<tr>
<th>1a. School or College</th>
<th>1b. Division</th>
<th>1c. Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS CAS</td>
<td>AMSC Division of Math Science</td>
<td>Geological Sciences</td>
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<tr>
<th>2. Course Prefix</th>
<th>3. Course Number</th>
<th>4. Previous Course Prefix &amp; Number</th>
<th>5a. Credits/CEUs</th>
<th>5b. Contact Hours</th>
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<th>10. Grading Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ A-F</td>
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</table>

<table>
<thead>
<tr>
<th>11. Implementation Date</th>
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<tbody>
<tr>
<td>From: Spring/2016</td>
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<table>
<thead>
<tr>
<th>12. ☐ Cross Listed with</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Stacked with GEOL A640</td>
</tr>
</tbody>
</table>

13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at www.uaa.alaska.edu/governance.

<table>
<thead>
<tr>
<th>Impacted Program/Course</th>
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<td>D. Van Dommelen</td>
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</tbody>
</table>

Initiator Name (typed): Donald M. Reeves  Initiator Signed Initials: ___________ Date: ______________

<table>
<thead>
<tr>
<th>14. General Education Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Oral Communication</td>
</tr>
<tr>
<td>☑ Written Communication</td>
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<td>☑ Natural Sciences</td>
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<tr>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>15. Course Description (suggested length 20 to 50 words)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive coverage of the fundamentals of Hydrogeology including physical and hydraulic properties of subsurface aquifers, Darcy's Law and the Ground Water Flow Equation, hydraulic head, storage and effective stress, regional ground water flow, aquifer hydraulics, and water well design and development. Laboratory time will be used to enhance data analysis, mathematical, and problem-solving skills.</td>
</tr>
</tbody>
</table>

16a. Course Prerequisite(s) (list prefix and number or test code and score)  min grade of C

16b. Co-requisite(s) (concurrent enrollment required)

16c. Automatic Restriction(s)

16d. Registration Restriction(s) (non-codable)

17. ☑ Mark if course has fees

18. ☐ Mark if course is a selected topic course

19. Justification for Action

Course focus is quantitative in nature and more suitable at 400-level than 300-level. Addition of prerequisites to address student deficiencies in math and physics. Laboratory is designed to improve students' data analysis, math, and problem-solving skills.
<table>
<thead>
<tr>
<th>Initiator (faculty only)</th>
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<th>Dean/Director of School/College</th>
<th>Date</th>
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<td></td>
</tr>
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<tr>
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<td>Date</td>
<td>Provost or Designee</td>
<td>Date</td>
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</table>
Course Content Guide  
University of Alaska Anchorage

GEOL A440  
Hydrogeology

I. Date of Initiation: Spring 2016

II. Course Information
   A. College: CAS  
   B. Course Subject: Geological Sciences  
   C. Course Number: GEOL A440  
   D. Number of Credits: 4.0 (3+1)  
   E. Course Title: Hydrogeology  
   F. Grading Basis: A-F  
   G. Course Description: Comprehensive coverage of the fundamentals of Hydrogeology including physical and hydraulic properties of subsurface aquifers, Darcy’s Law and the Ground Water Flow Equation, hydraulic head, storage and effective stress, regional ground water flow, aquifer hydraulics, and water well design and development. Laboratory time will be used as a recitation to enhance data analysis, mathematical, and problem-solving skill sets.
   H. Course Prerequisites: CHEM A105, GEOL A221, MATH A200, PHYS A124  
   I. Fee: Yes

III. Instructional Goals and Student Learning Outcomes
   A. Instructional Goals. The instructor will:
      1. Provide interactive PowerPoint lectures on the topics listed in the course description and course outline. These topics represent the theoretical and applied foundation of Hydrogeology.
      2. Use laboratory time as a recitation to facilitate the development and enhancement of students’ data analysis, mathematical, and problem-solving skill sets.
      3. Incorporate real-world hydrogeologic applications through an Anchorage Hydrogeology field trip, incorporation of actual hydrogeologic data in problem sets, and discussion of selected book highlighting real-world problem(s).
   B. Student Learning Outcomes and Evaluation. The students will:

<table>
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<tr>
<td>Acquire a solid understanding of the fundamental processes and theory used in hydrogeology.</td>
<td>Problem sets and exams.</td>
</tr>
<tr>
<td>Demonstrate and articulate understanding of real-world hydrogeologic problems and applications.</td>
<td>Problem sets and selected text discussion.</td>
</tr>
<tr>
<td>Enhance existing data analysis, mathematical, and problem-solving skill sets.</td>
<td>Problem sets and exams.</td>
</tr>
</tbody>
</table>
IV. Course Evaluations
Based on grades received on problem sets, exams, and attendance during book
discussion and field trip.

V. Course Level Justification
This course provides the necessary theoretical and applied foundations of
hydrogeology, and is typically taught at the 400- and graduate-levels (often stacked)
in the vast majority of Universities, both domestic and abroad.

VI. Topical Course Outline

A. Introduction to Hydrogeology
   1. Basic Concepts and Processes
   2. Worldwide Distribution of Water
   3. Highlighted Hydrogeology Applications

B. Properties of Aquifers
   1. Porosity and Porosity Computation
   2. Permeability
   3. Darcy’s Law
   4. Permeability Estimation for Unconsolidated Materials
   5. Basic Aquifer Concepts

C. Principles of Ground Water Flow
   1. Fluid Energy and Hydraulic Head
   2. Bernoulli Equation and Hubbert Force Potential
   3. Fluid Density and Viscosity
   4. Specific Discharge and Ground Water Velocity
   5. Laminar and Turbulent Flow Regimes

D. Ground Water Flow Equations
   1. Homogeneity/Heterogeneity and Isotropy/Anisotropy
   2. Gradient Operator and Partial Derivatives
   4. Overburden and Effective Stress
   5. Aquifer Storage and Compaction
   6. Solutions to the Groundwater Flow Equation for Confined and Unconfined
      Aquifers
   7. Capillarity

E. Regional Ground Water Flow Equations
   1. Zones of Recharge and Discharge
   2. Hubbert and Toth Models of Regional Flow
   3. Permeability Contrasts and Flow Barriers
   4. Ground Water – Surface Water Interaction
5. Field Water Balances
6. Hyporheic Zone Exchange

F. Geology and Ground Water Occurrence
   1. Unconsolidated Aquifers
   2. Consolidated Aquifers
   3. Tectonic Settings
   4. Coastal Aquifers and Tidal Influences

G. Water Wells
   1. Well Drilling
   2. Well Screens and Sediment Size Analysis
   3. Water Well Design
   4. Water Well Development
   5. Water Well Pumps

H. Estimation of Aquifer Parameters
   1. Stratigraphic Unit and Hydrostratigraphic Unit Designation
   2. Arithmetic, Geometric, and Harmonic Averaging and Averaging Rules
   3. Permeameters and Core Estimation of K
   4. Well Hydraulics: Pumping and Slug Tests
   5. Estimation of Hydraulic Properties from Pumping and Slug Tests
   6. Well Interference and Hydrogeologic Boundaries

I. Additional Reading (Either Ogalla Blue or Cadillac Desert)
   1. Highlight real-world problems identified in selected book and discuss potential solutions.
   2. Extrapolate real-world problems identified in book to other hydrogeologic settings.

VIII. Required Texts


Selected Book on Real-World Hydrogeologic Problem, e.g., Cadillac Desert and Ogallala Blue in Bibliography (subject to change).

VIII. Bibliography


### Course Action Request

**University of Alaska Anchorage**

**Proposal to Initiate, Add, Change, or Delete a Course**

<table>
<thead>
<tr>
<th>1a. School or College</th>
<th>1b. Division</th>
<th>1c. Department</th>
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<tbody>
<tr>
<td>AS CAS</td>
<td>AMSC Division of Math Science</td>
<td>Geological Sciences</td>
</tr>
</tbody>
</table>

#### 2. Course Prefix
- GEOL

#### 3. Course Number
- A645

#### 4. Previous Course Prefix & Number
- N/A

#### 5. Credits/CEUs
- 3

#### 5b. Contact Hours (Lecture + Lab)
- (3+0)

### Complete Course Title
- **Advanced Geothermal Energy**

#### Abbreviated Title for Transcript (30 character)

#### 6. Type of Course
- [ ] Academic
- [ ] Preparatory/Development
- [ ] Non-credit
- [ ] CEU
- [ ] Professional Development

#### 7. Type of Action:
- [x] Add
- [ ] Change
- [ ] Delete

#### 8. Type of Action: Add

If a change, mark appropriate boxes:

- [ ] Prefix
- [ ] Course Number
- [ ] Contact Hours
- [ ] Repeat Status
- [ ] Grading Basis
- [ ] Cross-Listed/Stacked
- [ ] Course Prerequisites
- [ ] Co-requisites
- [ ] Test Score Prerequisites
- [ ] Registration Restrictions
- [ ] General Education Requirement
- [ ] Class
- [ ] Level
- [ ] College
- [ ] Major
- [ ] Other CCG (please specify)

#### 9. Repeat Status No
- # of Repeats
- Max Credits

#### 10. Grading Basis
- [x] A-F
- [ ] P/NP
- [ ] NG

#### 11. Implementation Date
- From: Spring/2016
- To: /9999

#### 12. Cross Listed with
- [ ] GEOL A445

#### 13a. Impacted Courses or Programs:

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Initiator Name (typed): Donald M. Reeves  Initiator Signed Initials: _________ Date:________________

#### 13c. Coordination with Library Liaison
- Date: 4/3/15

#### 14. General Education Requirement
- [ ] Oral Communication
- [ ] Written Communication
- [ ] Quantitative Skills
- [ ] Humanities
- [ ] Fine Arts
- [ ] Social Sciences
- [ ] Natural Sciences
- [ ] Integrative Capstone

#### 15. Course Description (suggested length 20 to 50 words)

Comprehensive coverage of geothermal systems and relevant processes including conductive and convective heat flow, subsurface fluid flow, geothermal exploration, resource assessment, structural settings favorable for geothermal reservoirs, microseismicity, well scaling and corrosion, power generation and enhanced geothermal systems.

16a. Course Prerequisite(s) (list prefix and number or test code and score)

16b. Co-requisite(s) (concurrent enrollment required)

16c. Automatic Restriction(s)
- [x] College
- [ ] Major
- [x] Class
- [x] Level

16d. Registration Restriction(s) (non-codable)
- Graduate standing

17. [x] Mark if course has fees

18. [ ] Mark if course is a selected topic course

#### 19. Justification for Action

Taught previously as GEOL A690. Requesting permanent course number and catalog listing.

Initiator (faculty only)  Date

Donald M. Reeves  Initiator (TYPE NAME)

[ ] Approved  Dean/Director of School/College  Date

[ ] Disapproved

[ ] Approved  Undergraduate/Graduate Academic  Date

[ ] Disapproved  Board Chair

[ ] Approved

[ ] Disapproved  Provost or Designee  Date

[ ] Approved

[ ] Disapproved  Department Chair  Date

[ ] Approved

[ ] Disapproved  College/School Curriculum Committee Chair  Date

[ ] Approved

[ ] Disapproved
Course Content Guide  
University of Alaska Anchorage  

GEOL A645  
Geothermal Energy  

I. **Date of Initiation:** Spring 2016  

II. **Course Information**  
A. College: CAS  
B. Course Subject: Geological Sciences  
C. Course Number: GEOL A645  
D. Number of Credits: 3.0 (3+0)  
E. Course Title: Geothermal Energy  
F. Grading Basis: A-F  
G. Course Description: Comprehensive coverage of geothermal systems and relevant processes including conductive and convective heat flow, subsurface fluid flow, geothermal exploration, resource assessment, structural settings favorable for geothermal reservoirs, microseismicity, well scaling and corrosion, power generation and enhanced geothermal systems.  
H. Course Prerequisites: CHEM A105, GEOL A221, MATH A200, PHYS A124  
I. Fee: Yes  

III. **Instructional Goals and Student Learning Outcomes**  
A. Instructional Goals. The instructor will:  
   1. Provide interactive PowerPoint lectures on the topics listed in the course description and course outline. These topics represent the theoretical and applied foundations of Geothermal Energy from a natural science perspective.  
   2. Incorporate real-world geothermal reservoir applications through problem sets, selected geothermal reservoir case studies, and field trip to selected geothermal site.  

B. Student Learning Outcomes and Evaluation. The students will:  

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Evaluations</th>
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<tbody>
<tr>
<td>Acquire a solid understanding of the fundamental processes and relevant theory used in the geothermal field.</td>
<td>Problem sets and exams.</td>
</tr>
<tr>
<td>Demonstrate understanding of real-world problems and applications related to geothermal energy.</td>
<td>Problem sets.</td>
</tr>
<tr>
<td>Demonstrate proficiency in geothermal research through an individual research project on a selected geothermal reservoir.</td>
<td>Graduate Student Presentations</td>
</tr>
</tbody>
</table>
IV. Course Evaluations
Based on grades received on problem sets, exams, and graduate student presentations related to self-directed research on a selected geothermal reservoir.

V. Course Level Justification

Geothermal energy encompasses multiple scientific disciplines and requires a significant number of prerequisites. For these reasons, this topic is typically taught at the upper-division under-graduate and graduate levels at Universities, both domestic and abroad. The stacking of this course allows for both undergraduate and graduate students to receive training in this important topic.

Graduate students will select a geothermal reservoir and identify the geological and structural setting of the reservoir, heat source, exploration history, reservoir temperatures, operations and management strategies, and other relevant information. This self-directed research project will culminate in an in-class presentation that provides additional benefit to undergraduate students enrolled in the course.

VI. Topical Course Outline

A. Introduction to Geothermal Energy
   1. Origin of Earth’s Heat
   2. Composition of the Earth
   3. Conversion of Heat into Energy
   4. World Wide Energy Demands and Consumption
   5. Geothermal Resources of the United States

B. Heat Flow
   1. Heat Conduction
   2. Thermal Gradient
   3. Thermal Conductivity
   4. Heat Flow Maps
   5. Convection and Convective Heat Transfer
   6. Rayleigh Number and Natural Convection
   7. Geothermal Exploration and Convective Heat Transfer

C. Fluid Flow
   1. Porosity and Porosity Computation
   2. Permeability
   3. Darcy’s Law
   4. Fluid Energy and Hydraulic Head
   5. Bernoulli Equation and Hubbert Force Potential
   6. Fluid Density and Viscosity
   7. Darcy’s Law and Geothermal Reservoirs
8. Multiphase Darcy’s Law

D. Flow Through Fractured Media
   1. Cubic Law
   2. Types of Fractures
   3. Fault Type and Architecture
   4. Hydraulic Function of Faults
   5. Fluid Channeling Within Fractures
   6. Discrete Fracture Networks
   7. Statistical Fracture Network Analysis

E. Structural Settings Favorable for Geothermal
   1. Pacific Ring of Fire
   2. Magmatic Intrusions
   3. Crustal Extension
   4. Structural Settings Identified Within Great Basin
   5. Power Plant Examples

F. Well Scaling and Corrosion – Case Studies
   1. Diaz et al. (2005)
   2. Kaypakoglu et al. (2012)
   3. Ngothai et al. (2010)

G. Microseismicity – Case Studies
   1. Urban and Lermo (2012)
   2. Xu et al. (2012)

H. Geophysical and Remote Sensing for Geothermal
   1. Seismic
   2. Resistivity
   3. Magnetotelluric
   4. Gravity
   5. Borehole Geophysics
   6. Hyperspectral Analysis and Mineral Identification
   7. InSAR

I. Geothermal Power Plants and Power Generation
   1. Enthalpy – Power Relations
   2. Thermodynamic Efficiency
   3. Electrical Generation
   4. Fossil Fuel and Nuclear Power Plants
   5. Dry Steam Power Plants
   6. Single Flash Power Plants
   7. Double Flash Power Plants
   8. Binary Cycle Power Plant
   9. Cooling Towers
10. Advanced Geothermal Energy Conversion Systems

J. Enhanced Geothermal Systems
   1. Future of Geothermal Energy
   2. Shear Stimulation
   3. Hydraulic Fracturing

VIII. Required Texts


VIII. Bibliography


Geothermal Field over 31 years of commercial operations, Proceedings World Geothermal Congress, Antalya, Turkey.


1. School or College
   AS CAS

2. Course Prefix
   GEOL

3. Course Number
   A445

4. Previous Course Prefix & Number
   N/A

5. Credits/CEUs
   3

6. Complete Course Title
   Geothermal Energy

7. Type of Course
   ☑ Academic
   ☐ Preparatory/Development
   ☐ Non-credit
   ☐ CEU
   ☐ Professional Development

8. Type of Action:
   ☑ Add
   ☐ Change
   ☐ Delete

If a change, mark appropriate boxes:

- Prefix
- Credits
- Title
- Grading Basis
- Course Description
- Test Score Prerequisites
- Automatic Restrictions
- Class
- Level
- College
- Major
- Other CCG (please specify)

9. Repeat Status No
   # of Repeats
   Max Credits

10. Grading Basis
    ☑ A-F
    ☐ P/NP
    ☐ NG

11. Implementation Date
    From: Spring/2016
    To: /9999

12. Cross Listed with
    ☐ GEOL A645
    Cross-Listed Coordination

13a. Impacted Courses or Programs:

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</table>

Initiator Name (typed): Donald M. Reeves
Initiator Signed Initials: __________
Date: __________

13b. Coordination Email
    Date: 4/3/15
    submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)

13c. Coordination with Library Liaison
    Date: 4/3/15

14. General Education Requirement
    Mark appropriate box:
    ☑ Oral Communication
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    ☑ Humanities
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15. Course Description (suggested length 20 to 50 words)
    Comprehensive coverage of geothermal systems and relevant processes including conductive and convective heat flow, subsurface fluid flow, geothermal exploration, resource assessment, structural settings favorable for geothermal reservoirs, microseismicity, well scaling and corrosion, power generation and enhanced geothermal systems.

16a. Course Prerequisite(s) (list prefix and number or test code and score)
    [CHEM A105, GEOL A221, MATH A200, PHYS A124] min grade C

16b. Co-requisite(s) (concurrent enrollment required)

16c. Automatic Restriction(s)

- ☑ College
- ☐ Major
- ☑ Class
- ☐ Level

16d. Registration Restriction(s) (non-codable)

17. ☑ Mark if course has fees

18. ☐ Mark if course is a selected topic course

19. Justification for Action
    Taught previously as GEOL A490. Requesting permanent course number and catalog listing.

Initiator (faculty only)          Date
Donald M. Reeves                 __________

Initiator (TYPE NAME)             Date

Approved
Disapproved

Dean/Director of School/College
Date

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Undergraduate/Graduate Academic
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Date

Approved
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Course Content Guide
University of Alaska Anchorage

GEOL A445
Geothermal Energy

I. Date of Initiation: Spring 2016

II. Course Information
A. College: CAS
B. Course Subject: Geological Sciences
C. Course Number: GEOL A445
D. Number of Credits: 3.0 (3+0)
E. Course Title: Geothermal Energy
F. Grading Basis: A-F
G. Course Description: Comprehensive coverage of geothermal systems and relevant processes including conductive and convective heat flow, subsurface fluid flow, geothermal exploration, resource assessment, structural settings favorable for geothermal reservoirs, microseismicity, well scaling and corrosion, power generation and enhanced geothermal systems.
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   3. Magnetotelluric
   4. Gravity
   5. Borehole Geophysics
   6. Hyperspectral Analysis and Mineral Identification
   7. InSAR

I. Geothermal Power Plants and Power Generation
   1. Enthalpy – Power Relations
   2. Thermodynamic Efficiency
   3. Electrical Generation
   4. Fossil Fuel and Nuclear Power Plants
   5. Dry Steam Power Plants
   6. Single Flash Power Plants
   7. Double Flash Power Plants
   8. Binary Cycle Power Plant
   9. Cooling Towers
   10. Advanced Geothermal Energy Conversion Systems

J. Enhanced Geothermal Systems
   1. Future of Geothermal Energy
   2. Shear Stimulation
   3. Hydraulic Fracturing

VIII. Required Texts

VIII. Bibliography


## Course Action Request

### University of Alaska Anchorage

Proposal to Initiate, Add, Change, or Delete a Course

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<td>AMSC Division of Math Science</td>
<td>GEOL</td>
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</table>

<table>
<thead>
<tr>
<th>2. Course Prefix</th>
<th>3. Course Number</th>
<th>4. Previous Course Prefix &amp; Number</th>
<th>5a. Credits/CEUs</th>
<th>5b. Contact Hours (Lecture + Lab)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL</td>
<td>A657</td>
<td></td>
<td></td>
<td>(3+0)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>6. Complete Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Geology of Alaska</td>
</tr>
</tbody>
</table>

**Abbreviated Title for Transcript (30 character):**

<table>
<thead>
<tr>
<th>7. Type of Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
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</table>

<table>
<thead>
<tr>
<th>8. Type of Action:</th>
</tr>
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<tbody>
<tr>
<td>☑ Add</td>
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<table>
<thead>
<tr>
<th>9. Repeat Status No</th>
<th># of Repeats</th>
<th>Max Credits</th>
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<table>
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<tr>
<th>10. Grading Basis</th>
</tr>
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<tbody>
<tr>
<td>☑ A-F</td>
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</table>

<table>
<thead>
<tr>
<th>11. Implementation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>From: Spring 16/</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>12. Cross listed with</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Stacked with A457</td>
</tr>
</tbody>
</table>

### 13a. Impacted Courses or Programs:

List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at [www.uaa.alaska.edu/governance](http://www.uaa.alaska.edu/governance).

#### Impacted Program/Course

<table>
<thead>
<tr>
<th>Program/Course</th>
<th>Date of Coordination</th>
<th>Chair/Coordinator Contacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geological Sciences</td>
<td>K Crossen</td>
<td></td>
</tr>
<tr>
<td>Natural Sciences</td>
<td>F Rainey</td>
<td></td>
</tr>
<tr>
<td>AEST-COE</td>
<td>A Dotson</td>
<td></td>
</tr>
</tbody>
</table>

Initiator Name (typed): Kristine J Crossen  
Initiator Signed Initials: _______  
Date: __________

#### 13b. Coordination Email

Date: 4-3-15  
submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)

#### 13c. Coordination with Library Liaison

Date: 4-3-15

#### 14. General Education Requirement

Mark appropriate box:

- Oral Communication
- Written Communication
- Quantitative Skills
- Social Sciences
- Humanities
- Fine Arts
- Natural Sciences
- Integrative Capstone

#### 15. Course Description (suggested length 20 to 50 words)

Alaskan geology including physiographic provinces, earthquakes, volcanoes, plate tectonics, resources, glaciers, permafrost, rivers, coasts and wind. Emphasis on processes, landforms, and differences between specific areas in Alaska. Independent research and professional presentation required. Special Note: Students may be required to provide their own transportation for optional field trips.

#### 16a. Course Prerequisite(s) (list prefix and number or test code and score)

#### 16b. Co-requisite(s) (concurrent enrollment required)

#### 16c. Automatic Restriction(s)

- College    | Major    | Class    | Level |
- Graduate   | Standing |

#### 16d. Registration Restriction(s) (non-codable)

- Non-codable

#### 17. Mark if course has fees

#### 18. Mark if course is a selected topic course

#### 19. Justification for Action

Stacked with GEOL A457 and graduate students are required to produce an independent research project and present it to class.

<table>
<thead>
<tr>
<th>Initiator (faculty only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kristine J Crossen</td>
</tr>
</tbody>
</table>

Initiator (TYPE NAME)  
Date: __________

<table>
<thead>
<tr>
<th>Initiator (TYPE NAME)</th>
<th>Date</th>
<th>Dean/Director of School/College</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Disapproved</td>
<td></td>
</tr>
<tr>
<td>Disapproved</td>
<td></td>
<td>Approved</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Department Chair</th>
<th>Date</th>
<th>Undergraduate/Graduate Academic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
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<td>Disapproved</td>
<td></td>
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<tr>
<td>Disapproved</td>
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<td>Approved</td>
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<tr>
<th>Provost or Designee</th>
<th>Date</th>
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<tbody>
<tr>
<td>Approved</td>
<td></td>
</tr>
<tr>
<td>Disapproved</td>
<td></td>
</tr>
</tbody>
</table>

---

Initiator (faculty only)  
Kristine J Crossen  
Initiator (TYPE NAME)  
Date: __________

---

**Note:** This form is a template for Course Action Requests at the University of Alaska Anchorage. It includes fields for required information and options for coordination with impacted programs, courses, and libraries. The form is designed to ensure that all necessary information is documented and that the course change is properly reviewed and approved by various academic and administrative bodies.
Course Content Guide
University of Alaska Anchorage

GEOL A657
Advanced Geology of Alaska

I. Date of Initiation: Spring 2016

II. Course Information
A. College or School: CAS
B. Course Subject: Geological Sciences
C. Course Number: GEOL A657
D. Number of Credits: 3.0 (0+9)
E. Course Title: Geology of Alaska
F. Grading Basis: A-F
G. Course Description: Alaskan geology including physiographic provinces, earthquakes, volcanoes, plate tectonics, resources, glaciers, permafrost, rivers, coasts and wind. Emphasis on processes, landforms, and differences between specific areas in Alaska. Independent research and professional presentation required. Special Note: Students may be required to provide their own transportation for optional field trips.
H. Prerequisites: Graduate Standing
I. Fees: yes

III. Instructional Goals and Student Learning Outcomes

A. Instructional Goals. The instructor will:
   1) Guide students in reading and interpreting the professional literature.
   2) Introduce the regional geology and tectonic setting of specific field areas.
   3) Compare differences between locales to examine resources, landforms, and tectonics of Alaska.

B. Student Learning Outcomes. The students will:

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate and identify landscapes, ranges, rivers and cities across Alaska</td>
<td>Map exercises</td>
</tr>
<tr>
<td>Critically evaluate the professional literature</td>
<td>Graded reading summaries</td>
</tr>
<tr>
<td>Examine volcanoes and earthquakes within the Aleutian subduction zone and synthesize associated tectonics</td>
<td>Discussion and exams</td>
</tr>
<tr>
<td>Investigate resource formation processes and locations; examine specific Alaskan surface processes</td>
<td>Discussion and exams</td>
</tr>
<tr>
<td>Produce independent research project and present professional quality presentation.</td>
<td>Professional presentation</td>
</tr>
</tbody>
</table>
IV. Course Evaluation
Students will be evaluated on the basis of their map exercises, exams, summaries of professional readings, and class discussions. Graduate level students will produce independent research on an instructor-approved project and will present a professional quality presentation.

V. Course Level Justification
This course uses both the conceptual and intellectual skills obtained in previous geology courses (including physical and historical geology) to apply to the geology of Alaska. Students will not only learn new material, but will continue to develop and apply critical thinking skills, practice in scientific method, and synthesize the professional literature. Independent research using a primary data set and a professional quality presentation is required.

VI. Topical Course Outline

A. Physiographic provinces
   1. Locations and characteristics

B. Alaskan volcanoes and earthquakes
   1. Aleutian subduction zone, 1964 Alaska earthquake, 2002 Denali earthquake

C. Alaskan Tectonics
   1. Yakutat, Chugach, Peninsular, Wrangellia, and Yukon-Tanana terranes

D. Alaska resources
   1. Arctic Alaska terrane, North Slope petroleum province
   2. Cook Inlet oil, gas, and coal resources
   3. Gold – placer and lode deposits of Interior and Cook Inlet regions

E. Glaciers
   1. Processes, Cook Inlet history, Bering Glacier, Beringia, Qagnax Cave mammoths

F. Permafrost
   1. Processes of jacking, polygons, pingoes
   2. Engineering problems

G. Surface features: comparisons in different locales
   1. Rivers, aeolian, coasts
VII. Suggested Text(s)

There are no currently available texts that synthesize Alaskan geology. Students are required to read, produce written summaries and discuss the professional geologic literature.

VIII. Bibliography


1a. School or College  | 1b. Division  | 1c. Department  
AS CAS | AMSC Division of Math Science | GEOL  
2. Course Prefix | 3. Course Number | 4. Previous Course Prefix & Number | 5a. Credits/CEUs | 5b. Contact Hours (Lecture + Lab)  
GEOL | A457 | | 3 | (3+0)  
6. Complete Course Title  
Geology of Alaska  
Abbreviated Title for Transcript (30 character)  
7. Type of Course  
☑ Academic  
☐ Preparatory/Development  
☐ Non-credit  
☐ CEU  
☐ Professional Development  
8. Type of Action:  
☑ Add  
☐ Change  
☐ Delete  
If a change, mark appropriate boxes:  
☐ Prefix  
☐ Credits  
☐ Title  
☐ Grade Basis  
☐ Course Description  
☐ Test Score Prerequisites  
☐ Automatic Restrictions  
☐ Class  
☐ Major  
☐ College  
☐ Other  
☐ Course Number  
☐ Contact Hours  
☐ Repeat Status  
☐ Cross-Listed/Stacked  
☐ Course Prerequisites  
☐ Co-requisites  
☐ Registration Restrictions  
☐ General Education Requirement  
9. Repeat Status No  
# of Repeats  
Max Credits  
10. Grading Basis  
☑ A-F  
☐ P/NP  
☐ NG  
11. Implementation Date  
semester/year  
From: Spring 16/  
To: 9999/  
12. ☐ Cross Listed with  
☐ Stacked with  
☐ Cross-Listed Coordination Signature  
13a. Impacted Courses or Programs: List any programs or college requirements that require this course.  
Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at www.uaa.alaska.edu/governance.  
Initiator Name (typed): Kristine J Crossen  
Initiator Signed Initials: _________  
Date:________________  
13b. Coordination Email  
Date: 4-3-15  
submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)  
13c. Coordination with Library Liaison  
Date: 4-3-15  
14. General Education Requirement  
Mark appropriate box:  
☐ Oral Communication  
☐ Written Communication  
☐ Quantitative Skills  
☐ Humanities  
☐ Fine Arts  
☐ Social Sciences  
☐ Natural Sciences  
☐ Integrative Capstone  
15. Course Description (suggested length 20 to 50 words)  
Alaskan geology including physiographic provinces, earthquakes, volcanoes, plate tectonics, resources, glaciers, permafrost, rivers, coasts and wind. Emphasis on processes, landforms, and differences between specific areas in Alaska. Special Note: Students may be required to provide their own transportation for optional field trips.  
16a. Course Prerequisite(s) (list prefix and number or test code and score)  
GEOL A212 with minimum grade of C  
16b. Co-requisite(s) (concurrent enrollment required)  
16c. Automatic Restriction(s)  
☐ College  
☐ Major  
☐ Class  
☐ Level  
16d. Registration Restriction(s) (non-codable)  
17. ☑ Mark if course has fees  
18. ☐ Mark if course is a selected topic course  
19. Justification for Action  
Taught twice previously as 490 course. Replacing 490 with permanent course number.  
Initiator (faculty only)  
Kristine J Crossen  
Initiator (TYPE NAME)  
☑ Approved  
☐ Disapproved  
☐ Dean/Director of School/College  
Date  
☐ Approved  
☐ Disapproved  
☐ Undergraduate/Graduate Academic Board Chair  
Date  
☐ Approved  
☐ Disapproved  
☐ Provost or Designee  
Date  
☐ Approved  
☐ Disapproved  
☐ Department Chair  
Date  
☐ Approved  
☐ Disapproved  
College/School Curriculum Committee Chair  
Date  
☐ Approved  
☐ Disapproved  
Date  
Humanities
Course Content Guide  
University of Alaska Anchorage

GEOL A457  
Geology of Alaska

I. Date of Initiation: Spring 2016

II. Course Information
   A. College or School: CAS
   B. Course Subject: Geological Sciences
   C. Course Number: GEOL A457
   D. Number of Credits: 3.0 (0+9)
   E. Course Title: Geology of Alaska
   F. Grading Basis: A-F
   G. Course Description: Alaskan geology including physiographic provinces, earthquakes, volcanoes, plate tectonics, resources, glaciers, permafrost, rivers, coasts and wind. Emphasis on processes, landforms, and differences between specific areas in Alaska. Special Note: Students may be required to provide their own transportation for optional field trips.
   H. Prerequisites: GEOL A221 with minimum grade of C
   I. Fees: yes

III. Instructional Goals and Student Learning Outcomes

   A. Instructional Goals. The instructor will:
      1) Guide students in reading and interpreting the professional literature.
      2) Introduce the regional geology and tectonic setting of specific field areas.
      3) Compare differences between locales to examine resources, landforms, and tectonics of Alaska.

   B. Student Learning Outcomes. The students will:

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate and identify landscapes, ranges, rivers and cities across Alaska</td>
<td>Map exercises</td>
</tr>
<tr>
<td>Read the professional literature</td>
<td>Graded reading summaries</td>
</tr>
<tr>
<td>Examine volcanoes and earthquakes within the Aleutian subduction zone and synthesize associated tectonics</td>
<td>Discussion and exams</td>
</tr>
<tr>
<td>Investigate resource formation processes and locations</td>
<td>Discussion and exams</td>
</tr>
<tr>
<td>Examine surface processes particular to Alaska including glaciers, permafrost, rivers, and coastlines</td>
<td>Discussion and exams</td>
</tr>
</tbody>
</table>
IV. Course Evaluation
Students will be evaluated on the basis of their map exercises, exams, summaries of professional readings, and class discussions.

V. Course Level Justification
This course has a 200-level prerequisite and builds upon concepts from earlier courses.

VI. Topical Course Outline

A. Physiographic provinces
   1. Locations and characteristics

B. Alaskan volcanoes and earthquakes
   1. Aleutian subduction zone, 1964 Alaska earthquake, 2002 Denali earthquake

C. Alaskan Tectonics
   1. Yakutat, Chugach, Peninsular, Wrangellia, and Yukon-Tanana terranes

D. Alaska resources
   1. Arctic Alaska terrane, North Slope petroleum province
   2. Cook Inlet oil, gas, and coal resources
   3. Gold – placer and lode deposits of Interior and Cook Inlet regions

E. Glaciers
   1. Processes, Cook Inlet history, Bering Glacier, Beringia, Qagnax Cave mammoths

F. Permafrost
   1. Processes of jacking, polygons, pingoes
   2. Engineering problems

G. Surface features: comparisons in different locales
   1. Rivers, aeolian, coasts

VII. Suggested Text(s)
There are no currently available texts that synthesize Alaskan geology. Students are required to read, produce written summaries and discuss the professional geologic literature.
VIII. Bibliography


Course Action Request
University of Alaska Anchorage
Proposal to Initiate, Add, Change, or Delete a Course

1a. School or College  
AS CAS

1b. Division  
AMSC Division of Math Science

1c. Department  
Geological Sciences

2. Course Prefix  
GEOL

3. Course Number  
A699

4. Previous Course Prefix & Number

5a. Credits/CEUs  
1-6

5b. Contact Hours  
(Lecture + Lab)  
(0+3-18)

6. Complete Course Title  
Graduate Thesis

Abbreviated Title for Transcript (30 character)

7. Type of Course  
☒ Academic  ☐ Preparatory/Development  ☐ Non-credit  ☐ CEU  ☐ Professional Development

8. Type of Action:  
☒ Add  ☐ Change  ☐ Delete

If a change, mark appropriate boxes:

☐ Prefix  ☐ Course Number  ☐ Contact Hours  ☐ Repeat Status

☐ Credits  ☐ Title  ☐ Course Prerequisites  ☐ Co-requisites

☐ Grade Basis  ☐ Cross-Listed/Stacked  ☐ Co-requisites  ☐ Registration Restrictions

☐ Course Description  ☐ General Education Requirement

☐ Test Score Prerequisites  ☐ General Education Requirement

☐ Automatic Restrictions

☐ Class  ☐ Level  ☐ College  ☐ Major  ☐ Other  
☐ (please specify)

9. Repeat Status  
Yes   ☐ No  
# of Repeats

Max Credits  
12

10. Grading Basis  
☒ A-F  ☐ P/NP  ☐ NG

11. Implementation Date  
Semester/year

From: Spring/2016  
To: Fall/9999

12. ☐ Cross Listed with  ☐ Stacked with

Cross-Listed Coordination Signature

13a. Impacted Courses or Programs: List any programs or college requirements that require this course.

Please type into fields provided in table. If more than three entries, submit a separate table. A template is available at www.uaa.alaska.edu/governance.

<table>
<thead>
<tr>
<th>Impacted Program/Course</th>
<th>Date of Coordination</th>
<th>Chair/Coordinator Contacted</th>
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<tr>
<td>1.</td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
<td></td>
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</table>

Initiator Name (typed): LeeAnn Munk  
Initiator Signed Initials: __________________  
Date: __________________

13b. Coordination Email  
Date: 4-21-2015  
submitted to Faculty Listserv: (uaa-faculty@lists.uaa.alaska.edu)

13c. Coordination with Library Liaison  
Date: 4-21-2015

14. General Education Requirement  
Mark appropriate box:

☐ Oral Communication  ☐ Written Communication  ☐ Quantitative Skills  ☐ Humanities

☐ Fine Arts  ☐ Social Sciences  ☐ Natural Sciences  ☐ Integrative Capstone

15. Course Description (suggested length 20 to 50 words)

Planning, preparation, and completion of thesis for M.S. degree with emphasis in Geological Sciences research. Special Notes: Permission of graduate advisor required. May be repeated for a maximum of 12 credits.

16a. Course Prerequisite(s) (list prefix and number or test code and score)

16b. Co-requisite(s) (concurent enrollment required)

16c. Automatic Restriction(s)

☐ College  ☐ Major  ☐ Class  ☐ Level

16d. Registration Restriction(s) (non-codable)  
Graduate standing

17. ☒ Mark if course has fees

18. ☐ Mark if course is a selected topic course

19. Justification for Action

Adding this course for graduate level students conducting research in Geological Sciences for completion of a MS thesis.

Initiator (faculty only)  
Date  
[ ] Approved  ☐ Disapproved

Dean/Director of School/College  
Date  
[ ] Approved  ☐ Disapproved

13a.  
13b.  
14.  
15.  
16a.  
16b.  
16c.  
16d.  
17.  
18.  
19.  
Initiator (TYPE NAME)  
[ ] Approved  ☐ Disapproved

[ ] Approved  ☐ Disapproved

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[ ] Approved  ☐ Disapproved

[ ] Approved  ☐ Disapproved

[ ] Approved  ☐ Disapproved

[ ] Approved  ☐ Disapproved

[ ] Approved  ☐ Disapproved
Course Content Guide  
University of Alaska Anchorage

GEOL A699  
Graduate Thesis

I. Date of Initiation: Spring 2016

II. Course Information:
   A. College or School: CAS
   B. Course Subject and Number: GEOL A699
   C. Number of Credits: 1.0-6.0 (3-18)
   D. Course Title: Graduate Thesis
   E. Grading Basis: A-F
   F. Course Description: Planning, preparation, and completion of thesis for M.S. degree with emphasis in Geological Sciences research. Special Notes: Permission of graduate advisor required. May be repeated for a maximum of 12 credits.
   G. Status of Course Relative to Degree Program: Required course for graduate students conducting graduate level research in geological sciences for a MS thesis.
   H. Course Fees: no
   I. Lab Fees: yes
   J. Coordination: UAA faculty list-serv
   K. Cross-listing: none
   L. Course Prerequisites: none
   M. Restrictions: graduate level standing

III. Instructional Goals and Student Learning Outcomes:
   A. Instructional Goals. The instructor will mentor:
      1) The conceptualization and formulation of testable hypotheses based on observations from field work, lab experiments and literature review.
      2) Data analysis and interpretation, testing of hypotheses and integration of results with appropriate literature.
      3) Writing and completion of the final research in the form of a thesis.
   B. Student Learning Outcomes. The students will:
      1) Design and conduct original research in the field of geological sciences under the mentorship of the advisor and committee members. 
         Assessment: Thesis proposal and project, meetings, scheduled reports/presentations and the thesis.
      2) Analyze data, write and complete thesis with the goal of publishing the results in a refereed journal in the geological sciences. Assessment: Thesis project, meetings, scheduled reports/presentations and the thesis publication.
      3) Perform the scientific method to generate results appropriate for publication as a thesis or scientific paper. Assessment: Thesis proposal
and project, meetings, scheduled reports/presentations and the thesis publication.

4) Discuss and assess progress on research project with faculty research advisor and thesis committee through regularly scheduled meetings during the semester. **Assessment:** Thesis project, meetings, scheduled reports/presentations.

**IV. Course Evaluation**

Course grading is A-F. The evaluation methods, while at the discretion of the faculty member teaching the course, may include the initiation, continuation and/or successful completion of a graduate research project approved by the student’s committee and mentored by her/his advisor, culmination the a publishable thesis. Assessment is made through regularly scheduled meetings between the student and advisor and committee members to address the continuity and degree of progress, collection and analysis of reliable and reproducible data sets and the timely completion of directed research project.

**V. Course Level Justification**

Designed as a required core course for the MS student conducting research in geological sciences for a MS thesis. This is an advanced research course in the context of formulating testable hypotheses, mastering the appropriate scientific literature, experimental design, research methods, data analysis and writing. The student is expected to integrate content of the thesis with their other graduate level courses in geological sciences and successfully write up the results as part of the thesis research.

**VI. Topical Course Outline**

Variable

**VII. Suggested Text(s)**


UAA Department of Geological Sciences Requirements and Guidelines for MS thesis proposal and final thesis.

**VIII. Bibliography**