Reservoir Fluid Analysis
GEOL 4175
Fall 2021
E.L. Miller Science Building, Rm 332
W 7:00 pm – 9:30 pm

Name: Dr. Julie M. Bloxson
Email: BloxsonJM@sfasu.edu
Phone: (936) 468-2355
Office: E.L. Miller Science Building, Rm 309
Office Hours: MW 9:00 am – 11:00 am; TTh 8:30 am – 10:00 am; By Apt. All office hours are via zoom and in person.
Department: Geology

Text and Materials
3. Stable internet connection
4. Computer

Course Overview
1. Course material will be delivered via D2L. This is primarily an online course.
2. Modules open Sunday, and close the following Saturday.
3. All assignments must be turned in via D2L. Most will be over the dropbox feature. Some will be in the form of discussion posts.
4. Two exams, mostly practicals.
5. Weekly assignments.
6. Two term projects.
7. Class time is for discussion and help, not lecture. READ THE MATERIAL BEFORE COMING.
8. Class time is both live streamed and face to face.

Course Description
Reservoir Fluid Analysis (GEOL 5338) - Three semester hours. An introduction to the fundamentals of fluid analysis and Petrophysics. This course emphasizes determining the physical and chemical properties of rocks and their contained fluids (water, oil, and gas) in the subsurface. Properties will be determined using a combination of geophysical logs, core, and physical measurements within a borehole.

Fluid analysis meets for a minimum of 67.5 lecture contact hours during the semester. Students are required to complete assignments based on readings from the primary literature, participate in classroom discussions regarding current research topics, and complete periodic quizzes and exams over the course content, including a final exam. Students must also complete written
assignments that assess their ability to evaluate current research in geoscience, including experimental procedures, and data analyses and interpretation. Successful completion of all elements for the course requires at least six hours of out-of-class student work each week.

Course Requirements
This course is a graduate level experience in subsurface analysis using wireline logs, core data, and other potential sources of data, such as production or seismic. This will include:

- Formative evaluation, sampling and testing
- Understand scale of core, logs, wells, seismic in relation to the reservoir
- The nature, origin and properties of reservoir rocks including the main petrophysical parameters, porosity, permeability and water saturation
- Introduction to coring and the associated core analysis data
- Evolution of logging tool technology, methods of conveyance and depth measurement
- Formation evaluation data, principles of tool measurement and applications including gamma ray, SP log, porosity logs, resistivity and formation pressure
- Capillary distribution of fluids, free water level and fluid contacts
- Quick-look interpretation work flow through lithology recognition, reservoir/non-reservoir discrimination, fluid types and contacts, porosity estimation, formation water resistivity, water saturation, net reservoir and net pay.
- Computerized quick look Petrophysics
- Reservoir quality controls and rock typing methods
- Core calibration of porosity and water saturation
- Mineral volume methods
- Shale volume analysis
- Advanced logging tool interpretation techniques

Class time will be a time of discussion and problem-solving, rather than lecture. You are expected to have read the material for the week outlined below, which will facilitate content retention and aid in classroom discussions. I will also provide some supplemental material throughout the semester that is expected to be read before the designated class. These will consist of scientific research articles, excerpts from other books, and short course documents. There will be a combination of homework exercises and projects. Note: this class is primarily online, with the classroom time being for discussion and problem solving. All assignments and projects will be due online in the D2L platform. Each week’s module will open on Sunday morning, with all assignments due the following Saturday. If you need a quick how to work D2L, please let me know! I will gladly walk you through it and the course setup.

There will be a weekly homework exercises, due on Saturday. There will be a mid-term and final exam. Finally, there will be two projects that will cover major topics in the course.
Student Learning Outcomes

1. Properly explain the theory and functions of typical wireline tools, such as Gamma Ray, Resistivity and Neutron Density.
2. Quantitatively assess porosity, fluid saturation and type, and permeability using wireline log data.
3. Gather and integrate core and wireline log data on actual samples, and create a geologic model.
4. Identify mineralogy assemblages in the subsurface using petrophysical properties and calibrations.
5. Complete a subsurface study of a reservoir to determine fluid type and distribution across a field.

Grading Policy

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-90%</td>
<td>A</td>
</tr>
<tr>
<td>89-80%</td>
<td>B</td>
</tr>
<tr>
<td>79-70%</td>
<td>C</td>
</tr>
<tr>
<td>69-60%</td>
<td>D</td>
</tr>
<tr>
<td>59-0%</td>
<td>F</td>
</tr>
</tbody>
</table>

Weekly Assignments (~10 total; 25 pts each)
A weekly assignment will be given, worth 25 points each week. They are due each Saturday, and will be allocated between a discussion if present and the assignment.

Tests (100 pts each)
There is a mid-term and a final. These will be largely multiple choice and applied, although some theory knowledge will be tested. They will be administered through the D2L system.

Projects (150 pts each)
There will be two projects that will consist of well log analysis. One will consist of integrating core and log data to create a model that can be extrapolated beyond the well you are working on. The second project will consist of determining the fluid content of a reservoir and mapping changes across a field. This will be done using resistivity logs and surface measurements. Each project is worth 150 pts.

Test (2@100 pts each) – 200
Homeworks (~10@25 pts each) - 250
Projects (2@150 pts each) - 300
Total 750

Attendance Policy
Attendance in not mandatory for the in class sessions. However, they will help you succeed in class. **These sessions will not be recorded for later reference.** Use these sessions to ask questions and gather input from your fellow classmates.
Homework assignments need to be turned in on their due date, and will have 10% deducted for every day late. After 5 days late, they will no longer be accepted. To make-up an exam, only excused absences will be accepted (doctor’s note, etc., with proper documentation). We will arrange a time and place for the make-up exam, which will be a different exam than the one given in class.

Course Calendar

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Unit</th>
<th>Module</th>
<th>Topic(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23-Aug</td>
<td>1 - Introduction</td>
<td>1</td>
<td>Intro to well logging</td>
</tr>
<tr>
<td>2</td>
<td>30-Aug</td>
<td></td>
<td>2</td>
<td>Intro to petrophysics</td>
</tr>
<tr>
<td>3</td>
<td>6-Sep</td>
<td>2 - Tools</td>
<td>3</td>
<td>Quality Control, Caliper, Sp, Temp</td>
</tr>
<tr>
<td>4</td>
<td>13-Sep</td>
<td>4</td>
<td>4</td>
<td>GR/spectral gamma ray</td>
</tr>
<tr>
<td>5</td>
<td>20-Sep</td>
<td>5</td>
<td>5</td>
<td>Den/PE</td>
</tr>
<tr>
<td>6</td>
<td>27-Sep</td>
<td>6</td>
<td>6</td>
<td>NPHI/Acoustic</td>
</tr>
<tr>
<td>7</td>
<td>4-Oct</td>
<td></td>
<td>7</td>
<td>Resistivity</td>
</tr>
<tr>
<td>8</td>
<td>11-Oct</td>
<td>3 - Integrated Formation Evaluation</td>
<td>8</td>
<td>Clean Formation evaluation and shaley sand formation evaluation</td>
</tr>
<tr>
<td>9</td>
<td>18-Oct</td>
<td>4</td>
<td>9</td>
<td>Carbonate Formation evaluation</td>
</tr>
<tr>
<td>10</td>
<td>25-Oct</td>
<td></td>
<td>10</td>
<td>Source Rock evaluation</td>
</tr>
<tr>
<td>11</td>
<td>1-Nov</td>
<td>5</td>
<td>11</td>
<td>Archies/Water Resistivity/TDS</td>
</tr>
<tr>
<td>12</td>
<td>8-Nov</td>
<td>6</td>
<td>12</td>
<td>Permeability/Saturation Height Function</td>
</tr>
<tr>
<td>13</td>
<td>15-Nov</td>
<td>7</td>
<td>13</td>
<td>Rock Typing and Lithology reconstruction/Clay Mineral Modeling</td>
</tr>
<tr>
<td>14</td>
<td>22-Nov</td>
<td></td>
<td></td>
<td>Thanksgiving Break</td>
</tr>
<tr>
<td>15</td>
<td>29-Nov</td>
<td></td>
<td>14</td>
<td>Reservoir Modeling</td>
</tr>
<tr>
<td>16</td>
<td>6-Dec</td>
<td></td>
<td></td>
<td>FINALS</td>
</tr>
</tbody>
</table>

Credit Hour Justification

The lecture GEOL 5338 (3 credits) meets for a minimum of 4.5 lecture contact hours during the week for 15 weeks (150 minutes per week), plus the final exam, for a total of 67.5 contact hours. Students are required to complete assignments based on selected readings, along with periodic quizzes, and exams over the course content. Successful complete of all elements for the course requires at least six hours of additional out-of-class work each week.

Program Learning Outcomes

PLO 1. Demonstrate mastery of fundamental core geologic concepts (e.g., Economic Geology, Engineering Geology, Geochemistry, Geomorphology, Hydrogeology, Mineralogy, Petrology, Stratigraphy, and Structural Geology).

PLO 2. Demonstrate mastery of geologic procedures and methods accurately, appropriately, and efficiently, including incorporation of technology.
PLO 3. Students will conduct, present, and defend scientific research to show mastery of geologic concepts.

PLO 4. Students will demonstrate mastery in effective oral and visual communication.

PLO 5. Students will demonstrate mastery in effective written communication.

COVID-19 MASK POLICY Masks (cloth face coverings) are encouraged in the classroom. They are to be worn over the nose and mouth, and appropriate physical distancing is encouraged.

Academic Integrity (4.1) Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit. Please read the complete policy at http://www.sfasu.edu/policies/4.1-student-academic-dishonesty.pdf.

Withheld Grades Semester Grades Policy 5.5) Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average. For additional information, go to http://www.sfasu.edu/policies/course-grades-5.5.pdf.

Students with Disabilities To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to
be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

SFASU values students' mental health and the role it plays in academic and overall student success. SFASU provides a variety of resources to support students' mental health and wellness. Many of these resources are free, and all of them are confidential.

On-campus Resources:
SFASU Counseling Services
www.sfasu.edu/counselingservices
3rd Floor Rusk Building
936-468-2401

SFASU Human Services Counseling Clinic
www.sfasu.edu/humanservices/139.asp
Human Services Room 202
936-468-1041

Crisis Resources:
Burke 24-hour crisis line 1(800) 392-8343
Suicide Prevention Lifeline 1(800) 273-TALK (8255)
Crisis Text Line: Text HELLO to 741-741