Course Syllabus: Advanced Formation Evaluation

McCoy College of Science, Mathematics, and Engineering
GEOS 5123
Spring 2021

Contact Information

Instructor: Dr. W. Scott Meddaugh
Office: Bolin 307F and Zoom
Office hours: "Drop in" office visits will handled via Zoom. Additional detail in D2L
Office phone: (940) 397-4469. Messages may be left, but email is preferred as email tends to be answered quicker.
University e-mail: scott.meddaugh@mwsu.edu

Course Instructional Mode

This course will initially be presented as an asynchronous online course though it may switch to an on campus/normal mode should the Covid-19 situation change. In the initial asynchronous mode all lectures are in D2L as voice-over .mp4 files and standard printable .pdf files. Some "real time/live" lectures during the normal class meeting time (Tuesday and Thursday at 10:30am) may be provided via Zoom. These special events will be announced via D2L two-three days in advance. Labs will be presented in real time via Zoom during normal lab time (Tuesday, 9am; Zoom attendance required) or online as voice-over .mp4 files or standard printable .pdf files. Check D2L news on regular basis. Lectures (video and PowerPoint), Lab Assignments, and Homework Assignments are provided in D2L. All regular exams are likely to be administered online using D2L. Note that he Final Exam may be project-based rather than a "regular" exam.

The lecture portion of this course (which includes the three exams) is presented in what is termed fully "asynchronous" mode which means that students may "attend" the lecture at a time of their choosing via D2L. Students may work ahead on lectures, homework, labs, research paper, and the three exams (or two exams and a final project) but will be penalized for falling behind the syllabus schedule (see grading section for details on late penalties). Note that labs will start January 19, 2021. Labs will follow the schedule at the end of this document.

Note that all D2L-related issues and technical problems should be handled via D2L support at this link: https://msutexas.edu/distance/online-courses.php prior to the start of the semester. You will need to be able to provide homework, lab reports, and research paper in a format compatible with D2L (e.g. .doc, .pdf, .jpeg, etc. based on your hardware/software of choice. Files for the D2L drop boxes may be generated by software on your computer, image files obtained via scanning (many printers have this capability), or by submitting an image file obtained using a cell phone. Note that Apple specific formats such a ".heic" or

".pages" files cannot be read within D2L at the present time. Software that students are expected to have access to includes Microsoft Office or equivalent.

Course Description

A Lecture and Lab-based graduate-level course focused on advanced topics in formation evaluation from both a geological and engineering perspective for both conventional and unconventional (self-sourced or basin-centered) oil and gas reservoirs. The course focuses on the determination of reservoir lithology (simple and complex), reservoir porosity, and reservoir fluid saturation and related properties such as wettability and capillarity from well log, routine core, and special core data. In addition to learning to read and use "standard" well logs such as gamma ray, density, photoelectric, sonic, and neutron logs students will also study the application of NMR and other "specialty" or less commonly used wells log data (e.g. image, temperature, pressure) for both conventional clastic and carbonate reservoirs as well as unconventional reservoirs. Quantitative lab exercises will focus on deterministic and probabilistic results obtained from well log and core data and their impact on reservoir volumetric and continuity determinations. Time will also be devoted to OOIP assessment methodologies using deterministic and uncertainty focused workflows. Students will learn to use state-of-the-art software programs to develop business-based decisions on reservoir characterization and development projects. The course outline/syllabus contains a detailed schedule including a list of specific topics and corresponding textbook readings. Students are expected to develop and present a "professional meeting" appropriate presentation on a formation evaluation or reservoir assessment topic, or a reservoir case history. The subject of AI and data mining will also be discussed. If time allows, students will develop an economic model to assess a potential field development project. The course outline/syllabus contains a detailed schedule including a list of specific topics In addition to the PowerPoint-based lectures, you are also expected to read the assigned technical papers (mostly from the AAPG and SPE online accessible "libraries"). Any non-AAPG or non-SPE papers will be provided via D2L. There is no textbook for this class.

The Lab portion of the course includes hands-on projects ranging from constructing and interpreting cross sections, constructing and interpreting maps commonly used by petroleum geologists (e.g. structure, isopach, and reservoir property maps), deterministic and probabilistic volumetric and reserve calculations using Excel and @RISK software, well log interpretation for lithology, porosity, and saturation, Decline Curve Analysis (DCA), and Reserves Calculation and Reporting. **Note that all Labs will be introduced via Zoom during the normal lab time (Tuesdays at 9:30 starting on January 19, 2021)**

Required Textbook & Instructional Materials

No required textbook. Readings will be posted in D2L or available through the library via links (AAPG, SEG, and SPE online libraries) or readings posted in D2L.

Student Handbook

Refer to: https://msutexas.edu/student-life/_assets/files/handbook.pdf or most recent MSUTexas Student Handbook

Academic Misconduct Policy & Procedures

Academic Dishonesty: Cheating, collusion, and plagiarism (the act of using source material of other persons, either published or unpublished, without following the accepted techniques of crediting, or the submission for credit of work not the individual's to whom credit is given). Additional guidelines on procedures in these matters may be found in the Office of Student Conduct and also in the student handbook.

Grading

Note: No homework, lab assignments, or research papers may be submitted after 4/24/2021. The Table below (next page) summarizes the grading policy for this course.

There will be three lecture exams, the first two will each determine 15% of your final grade and the third ("final") exam which may be a project rather than a traditional exam will determine 20% of your course grade. Note that all lecture exams are "cumulative and comprehensive"; all prior material covered in lecture and lab, textbook readings, and any assigned readings will be included on exams. The "lecture" portion of the course will account for 50% of your final course grade. The "lab" portion of your grade will account for a total 35% of your final course grade. The lab grade will be derived as follows: 85% based on assigned labs and 15% on homework assignments. Completion of all homework and lab assignments on time is expected. Given appropriate prior notice, labs may be made up within one week without penalty. Labs and homework submitted late may be subject to a lab exercise grade penalty as follows 10% for five days past due; 20% for one week past due; 30% for two weeks past due. After two weeks, a missed homework or lab assignment may be given a grade of zero. The lab and homework assignments will be posted in D2L. Finally, the Research Paper and Presentation (details in separate section below) accounts for the 15% of your final grade; each counts 50% towards the overall Research paper grade. An electronic (MSWord or pdf) version of your completed Research Paper is due per the syllabus schedule. The penalty for late submission of the research paper is as follows: 10% for five days past due; 20% for one week past due; 30% for two weeks past due; after two weeks a grade of zero may be recorded for the Research Paper grade. An electronic version (MS PowerPoint or pdf) is due per the syllabus schedule. The topic for your Research Paper is due per the syllabus schedule.

Table 1: Points allocated to graded item or group of items discussed in the Grading Section above.

Graded Items	Contribution to Final Course Grade
Exam 1	15%
Exam 2	15%
Final Exam (may be a "take home project" or traditional online Q&A style exam)	20%
Lab Grade (includes homework, lab exercises/reports, lab participation and attendance)	35% (total)
Research Paper and Presentation	15%

Table 2: Final grade determination (grades are normally rounded up to the nearest integer before assigning the final course letter grade. This means, for example, that a final calculated course grade of 89.8% will be rounded up to a final course grade of 90.)

Grade	Points
A	90 and above
B	80-89
C	70-79
D	60-69
F	Less than 60

Homework

See Grading Section for details – All Homework must be submitted via the appropriate and specific D2L drop box. Formats used must be compatible with D2L (Apple proprietary formats such as ".heic" and ".pages" are not supported by D2L at this time. Grade penalties for late submittal may be applied; see grading section for details.

Lab Assignments

See Grading Section for details – All Lab Assignments must be submitted via the appropriate and specific D2L drop box. Formats used must be compatible with D2L (Apple proprietary formats such as ".heic" and ".pages" are not supported

by D2L at this time). Grade penalties for late submittal may be applied; see grading section for details. Note that should the university lab used by this course (Bolin 105) be closed due to Covid-19 related issues or concerns, alternative lab assignments will be posted that will not make use of software that is only available on campus.

Click here to enter text.

Research Paper and Presentation

Research paper and presentation composite grade is 15% of final course grade. Research papers must be between 3500 and 5000 words (about 7-10 pages of text based on 11-pt or 12-pt font; word count per MSWord's word count tool) and be no longer than 20 total pages including illustrations and title page. Figures and/or tables (with captions) may be included within text or at end of the paper (proper credit must be given for figures, maps, pictures that you include in your report). Format for the report is MS Word or pdf file. The digital copy to be submitted per the course schedule/syllabus. Your paper must be organized as follows:

1. **Title and author name on front page.** Nothing else on the front-page, please!
2. **Abstract** – 250 word limit summarizing your paper including a sentence on why you chose the particular topic
3. **Introduction** – Opening paragraphs of your paper that describe the topic in general, its importance or application to you and the community, and why you choose the particular topic
4. **Main Body** – Discussion of what your research revealed to you and what you want to share with the reader
5. **Conclusion(s)** – the key message or "take-away" points that you expect the reader to remember
6. **References** – list of references you used to research and write your paper; minimum number of primary peer-reviewed (journal) references is five.

Failure to follow the organizational and heading structure given above is an automatic 20% grade deduction! Failure to follow the length requirement may result in additional 10% grade deduction. Failure to properly cite your sources in the paper or presentation may result in a 10% grade reduction - please make sure that for any map, picture, graph or other illustration that you included in your paper has the source/reference in the caption. Presentations will be completed using PowerPoint. In addition to the "normal" PowerPoint file a narrated PowerPoint file must also be submitted as there will may be no opportunity to have in-person presentations. Papers and presentations are due as per the syllabus schedule. See the Late Submission Penalties section for information on late submittals. Research papers and presentations submitted more than one week late may be given a grade of zero. Note: No work may be submitted after 4/24/2021. All Research Papers must be submitted in Microsoft Word or PDF format. Presentations to be submitted in MS PowerPoint Format

(normal, and narrated). Presentations must follow any posted format "guidelines" in D2L (course information folder). You will have 20 minutes for your Presentation which may be given as voice-over PowerPoint or a "live" via Zoom meeting. You may be asked questions (either from Dr. Meddaugh or classmates) and your answers will count towards your overall Research Paper grade. Your Presentation file must be submitted to the Research Paper D2L Dropbox. Large files for D2L may need to be submitted in parts.

All research paper topics must be approved in advance.

Extra Credit

There are no Extra Credit opportunities in this course.

Class and Lab Attendance Policy – Important!

As this course is being presented essentially online, students should follow the syllabus schedule or work-ahead. Any changes will be announced in advance via D2L news. D2L news will also be used to announce Zoom sessions.

Exams

See Grading Section for details. All in-class exams will have a time limit of 55 minutes for the first two Exams and 110 minutes for the Final Exam (an alternative Final Exam "project" may be substituted for the "classic test" final). Any "take home final exam/project" may have significantly longer time limits. Exam format is variable and may include true/false questions, multiple-choice questions, and short answer/problem questions on in-class exams or "large" problems on "take-home" exams. Students needing extra time for exams must supply a note from DSS. Late completion penalties for exams may be as much as one letter grade per day late. All exams are administered through D2L and open/close time will be given in the syllabus.

Extra Credit Opportunities

There are no Extra Credit opportunities in this course.

Late Submission Penalties

Late work will be accepted through 4/24/2021. However, the following penalties will apply in all cases of late submittals: 10% for one week past due; 25% for two weeks past due; 50% for three weeks past due; after three weeks a grade of zero may be recorded.

Important Dates

Last Day to drop with a grade of "W:" 4pm, April 23, 2021.
Refer to: Drops, Withdrawals & Void

Desire-to-Learn (D2L)

Extensive use of the MSU D2L program is a part of this course. Each student is expected to be familiar with this program as it provides a primary source of communication regarding assignments, examination materials, and general course information. You can log into D2L through the MSU Homepage. If you experience difficulties, please contact the D2L support group.

Online Computer Requirements

Taking a course with considerable online class requires you to have access to a computer with reasonable Internet access to complete and upload your assignments. It is your responsibility to have (or have access to) a working computer in this class. Assignments and tests are due by the due date, and personal computer technical difficulties may not be considered as a reason for the instructor to allow students extra time to submit assignments, tests, or discussion postings. Computers are available on campus in various areas of the buildings as well as the Academic Success Center. Your computer being down is not an excuse for missing a deadline or an exam! There are many places to access your class! Our online classes can be accessed from any computer in the world which is connected to the internet. Contact your instructor immediately upon having personal computer trouble. If you have technical difficulties in the course, there is also a student helpdesk available to you. The college cannot work directly on student computers due to both liability and resource limitations however they are able to help you get connected to our online services. For help, log into D2L**.**

Change of Schedule

A student dropping a course (but not withdrawing from the University) within the first 12 class days of a regular semester or the first four class days of a summer semester is eligible for a 100% refund of applicable tuition and fees. Dates are published in the Schedule of Classes each semester.

Refund and Repayment Policy

A student who withdraws or is administratively withdrawn from Midwestern State University (MSU) may be eligible to receive a refund for all or a portion of the tuition, fees and room/board charges that were paid to MSU for the semester. HOWEVER, if the student received financial aid (federal/state/institutional grants, loans and/or scholarships), all or a portion of the refund may be returned to the financial aid programs. Two formulas (federal and state) exist in determining the amount of the refund. Examples of each refund calculation will be made available upon request from the Registar.

Services for Students with Disabilities

In accordance with Section 504 of the Federal Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, Midwestern State University endeavors to make reasonable accommodations to ensure equal opportunity for qualified persons with disabilities to participate in all educational, social, and recreational

programs and activities. After notification of acceptance, students requiring accommodations should make application for such assistance through Disability Support Services, located in the Clark Student Center, Room 168, (940) 397-4140. Current documentation of a disability will be required in order to provide appropriate services, and each request will be individually reviewed. For more details, please go to Disability Support Services.

College Policies

Campus Carry Rules/Policies are given here: Campus Carry Rules and Policies

Smoking/Tobacco Policy

College policy strictly prohibits the use of tobacco products in any building owned or operated by the university. Adult students may smoke only in the outside designated-smoking areas at each location.

Alcohol and Drug Policy

To comply with the Drug Free Schools and Communities Act of 1989 and subsequent amendments, students and employees of Midwestern State are informed that strictly enforced policies are in place, which prohibits the unlawful possession, use or distribution of any illicit drugs, including alcohol, on university property or as part of any university-sponsored activity. Students and employees are also subject to all applicable legal sanctions under local, state and federal law for any offenses involving illicit drugs on University property or at University-sponsored activities.

Grade Appeal Process

Students who wish to appeal a grade should consult the Midwestern State University Undergraduate Catalog

Notice

Changes in the course syllabus, procedure, assignments, and schedule may be made at the discretion of the instructor. Changes will be communicated to all students through D2L. Please check the course D2L news on a regular basis for schedule updates.

Course Schedule

Course schedule detail is given on the next several pages. The first table lists lecture topics, research paper due date, and scheduled exams (open/close times to be posted in D2L). The second table lists the due dates for the lecture homework assignments, lab assignments, and research paper/presentation. Labs are normally due one week after assignment. Exceptions and/or updates will be posted in D2L. Check the D2L news daily for updates. Changes in the course syllabus, procedure, assignments, and schedule may be made at the discretion of the instructor anytime during the semester. Changes will be communicated to all students through D2L**.** Please check the course D2L news on a regular basis for schedule updates.

Course Schedule – Lecture Topics, Research Paper/Presentation, and Exams (Page 1 of 2)

Date	Lecture Topic, Research Paper Related Dates, and Exam Dates
12-Jan	Topic 1 - Course Introduction
14-Jan	Topic 2 – Data Acquisition
19-Jan	Topic 3 – Introduction to Rock and Fluid Properties; Topic 4 – The GR Log
21-Jan	Topic 5 – Rock and Fluid Properties: Porosity and Lithology Part 1
26-Jan	Topic 5 – Rock and Fluid Properties: Porosity and Lithology Part 2
28-Jan	Topic 5 – Rock and Fluid Properties: Saturation (Sw)
2-Feb	Topic 6 – Coring and Core Data
4-Feb	Topic 7 – NMR Log
9-Feb	Topic 8 – Dipmeter and Image Logs
11-Feb	**Exam 1**
16-Feb	Topic 9 - Introduction to Uncertainty Assessment
18-Feb	Topic 10 - Univariate and Bivariate Statistics
23-Feb	Topic 11 – Spatial Statistics (Semivariogram), Random Variables and Random Functions
25-Feb	Topic 12 – Estimation and Kriging
2-Mar	Topic 12 – Estimation and Kriging (continued)
4-Mar	Topic 13 – Conditional Simulation
9-Mar	Topic 14 – Multipoint Simulation (MPS)
11-Mar	Review
16–Mar	**Exam 2**
18-Mar	Topic 15 - Reservoir Development, Engineering, Reserves and Commerciality – Part 1
23-Mar	Topic 15 - Reservoir Development, Engineering, Reserves and Commerciality – Part 2
25-Mar	Topic 16 - Decision Analysis
30-Mar	Topic 17 – Data Mining
1-Apr	**No Class**
6-Apr	Topic 18 – TBA
8-Apr	Topic 19 – TBA
13-Apr	Topic 20 - Reservoir Project Case History – First Eocene Reservoir
15-Apr	Topic 21 – Reservoir Volumetrics Case History – Humma Marrat Reservoir
20-Apr	Student Presentations
22-Apr	Student Presentations
23-Apr	**Final Exam or Final Project Due at 5pm**

Course Schedule for Labs and Homework. (Required readings will be assigned via D2L News and/or as part of the Posted Lectures.)

Date	Lab Topic, **Research Paper**
Jan – 19	Lab A: Excel – Your Retirement Plan
Jan – 26	Lab B: Uncertainty Assessment Using @Risk
Feb – 2	Lab C: Well Log Interpretation 1
Feb – 9	Lab D: Well Log Interpretation 2
Feb – 16	Lab E: Well Log Interpretation 3
Feb – 23	Lab F: Well Log Interpretation 4
Mar – 2	Lab G: TBA
Mar – 9	Lab H: Probabilistic Volumetrics/Reserves 1
Mar – 16	Lab I: Probabilistic Volumetrics/Reserves 2
Mar – 23	Lab J: Probabilistic Volumetrics/Reserves 3
Apr – 6	Lab K: TBA
Apr – 13	Lab L: TBA
Apr – 20	**No Lab**
Apr – 23	**Last Day to Submit Any Late Assignments for Partial Credit. Items must be submitted by 4pm CDT. Grade penalties per the course syllabus may apply.**

Homework Schedule is a function of the lecture schedule and as such will be assigned during lectures. Required reading will also be assigned as a function of the lecture schedule and will be assigned during lectures and/or labs. All homework and required reading assignments will be posted in D2L news as well (along with due dates for homework). Readings may provided in the Required Reading folder in D2L or by way of MSU Library links to the AAPG DataPages, SPE OnePetro, and SEG libraries during lectures.

End of course syllabus.