

PETROLEUM ENGINEERING DESIGN PROJECT - PET E 496 WINTER 2025

Dr. Tayfun Babadagli

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OFFICE HOURS: Anytime if the instructor is available, if not, ask for an appointment.

Teaching Assistants:
Lixing Lin (lixing.lin@ualberta.ca)

MEETING HOURS:
Lecture: Thursday 1:30-2:20 p.m. (GSB 5-59)
Seminars: Wednesday 2:00-4:50 p.m. (GSB 8-11) and Thursday 2:30-5:20 (GSB 5-59)

COURSE OUTLINE

This course is designed to deal with special case studies in the petroleum industry. You are expected to design and prepare a project on a given reservoir/field using the following:

- Analysis of reserves and production history, assessment of the current status of the field.
- Prediction of production and operating procedures related to the project
- Application of economics in the analysis of profitability
- Economics and planning as tools for a management position, analysis of risks

You will be divided into teams of four students (team assignments to be made in the first class). Once the teams are formed, each team will be assigned a project. There will be scheduled meetings with the teams during the seminar hours.

SCHEDULED CLASSROOM MEETINGS

Jan 8: Syllabus, student grouping (2:00-3:50 pm),

Jan 9: Description of the expected work and examples, assignment of projects, methodology, software packages (1:30-4:50 pm),

Jan 15: AccuMap presentation (2:00pm-2:50pm),

Jan 16: Introduction to Value Navigator software (1:30pm-5:20pm),

Feb 26 and 27 (TENTATIVE): Introduction to CMG software (2:00pm-5:00pm),

Feb 5-6: Individual group meetings (15 min for each group). General review, problems encountered, evaluation of the progress, questions, brief description of the development plan. Schedule TBA.

Feb 12: Mid-term presentations.

Mar 5-6: Individual group meetings (15 min for each group). Problems encountered, evaluation of the progress, questions, review of mid-term presentation. Schedule TBA.

Apr 3: Final presentations (1:30pm-4:50pm).

When needed, occasional classroom meetings will be held (TBA a week in advance). Help desk (mainly for simulation packages) provided by the TAs will be available after the midterm presentation.

Contact instructor or teaching assistants if you need additional meetings as a group or individual.

REQUIREMENTS

- Participation to
 - Two individual group meetings.
 - Mid-term presentations: 10 min oral presentation on **Feb 12, 2025.**
 - Final presentations: Oral presentation on project findings to peers on **April 3, 2025.**
- Submission of final report (one per team) due on **April 3, 2025.**

MARKING

- 50 % for final report (content and report quality)
- 50 % for final presentation (content and presentation quality)

DATA FOR PROPERTY EVALUATION

1. Exploration and drilling history
 - history of area (type of hydrocarbon, etc.); completion practices
2. Geology
 - structure maps; sequence of formations; dip and strike of reservoir
3. Petrophysical data
 - well logs; core analysis; porosity; permeability; rock properties
4. Pressure and temperature
 - initial pressure and temperature; pressure/production history
5. Fluid analysis
 - types of fluid; fluid composition; phase behavior; formation volume factors; viscosity; density
6. Production history
 - daily oil/gas rates; WOR; GOR; cumulative injection/production; well locations; secondary/enhanced recovery schemes
7. Economic analysis
 - costs, including drilling, completion, facilities, workovers/recompletions; loans, revenues

SUGGESTED READING

- Babadagli, T. 2007. Development of Mature Oil Fields — A Review. *J Pet Sci and Eng* **57** (2007) 221–246. <http://doi:10.1016/j.petrol.2006.10.006>.
- Babadagli, T., Al-Bemani, A., Boukadi, F., et al. 2007. Experimental and Numerical Evaluation of the Feasibility of Nitrogen Injection into a Mature Layered Light-Oil Reservoir. *Oil Gas European Magazine* **33** (2): 83-87).
- Boukadi, F. H., Bemani, A. S., and Babadagli, T. 2005. Understanding Governing Fluid Flow Mechanisms in a Mature Omani Oil Field - A Case Study. *Oil Gas European Magazine* **31** (2): 61-67.
- Coste, J.-F. and Valois, J.-P. 2000. An Innovative Approach for the Analysis of Production History in Mature Fields: A Key stage for Field Re-engineering. *Society of Petroleum Engineers*. <http://doi:10.2118/62880-MS>.
- Coste, J.-F., Valois, J.-P., Mouret, C., et al. 2002. Data Mining Techniques For Optimizing Fast Track Re-engineering of Mature Fields. *Society of Petroleum Engineers*. <http://doi:10.2118/78333-MS>.
- Demirmen, F. 2007. Reserves Estimation: The Challenge for the Industry. *JPT* **59** (05). <https://doi.org/10.2118/103434-JPT>.
- Garb, F. A. 1985. Oil and Gas Reserves Classification, Estimation, and Evaluation. *JPT* **37** (03). <https://doi.org/10.2118/13946-PA>.
- Patricelli, J.A. and McMichael, C.L. 1995. An Integrated Deterministic/Probabilistic Approach to Reserve Estimations. *JPT* 47 (01). <https://doi.org/10.2118/28329-PA>.

Final Report Outline

- Summary of work done:
 - Executive Summary
 - Introduction
 - Scope of Project
 - Description/**Analysis of the Field** and Problems
 - Geology (if relevant)
 - **Results** (provide sample calculations, **reserve evaluation by different methods, process to increase reserves, economic evaluation**) – present in tabular and graphical form
 - Discussion – **Development Plans** with Justifications
 - Conclusions and Recommendations
 - References (SPE format)
 - Appendices (raw data, calculations, computer program outputs, figures, maps, logs and other material used in performing calculations, etc.)
- Suggested not to exceed ~25 pages, excluding appendices

General Points

The emphasis in the marking of reports is on the “**Results, and Analysis and Discussion**” sections. A good understanding of the concepts of the work enables a good and thorough analysis of the data.

Originality and creativity will be the other assets for extra credit.

The final reports must be typed using a word processor. Reports should be written in the past tense and impersonally. An occasional personal note can enliven a report, but do not write it all in the first person. Make it interesting, challenging and succinct.

Guidance on Report Writing

A report, especially one produced in an academic environment, is written for the purpose of conveying information. The information to be transmitted in these reports is intended to contain:

- 1) Your understanding of the underlying principles behind the topic, and how your work conforms.
- 2) Your ability to plan and conduct the work so as to obtain significant results in a reasonable timeframe.

Copying or re-hashing sections of textbooks, or other students' reports serves little purpose. You are recommended to use the following headings:

1. Title Page

This page should include the following: class number, and title of report, name of the students along with their ID, group number, and date.

2. Cover Letter

This is an executive summary – maximum 2 pages. It should be addressed properly to the instructor with the name spelled correctly. It defines exactly what you set out to perform and what you hope to learn from it, and includes significant findings. It should be signed by the group members.

This is the most important section. It conditions the attitude of your reader. When you are working for a living this is the only part of your reports which will be read by the people who matter.

The cover letter should summarize the whole work: what you set out to do, what you actually did, and the main results you obtained. Be specific, and include numbers wherever possible. For instance, do not say “high efficiencies were obtained” but “the measured efficiency was $72 \pm 4\%$ ”.

3. Theory, Concepts and Objective of the Work

If you have already covered the theory underlying the project in a lecture course then you can deal with this section briefly by highlighting the important features. You need to give just enough to show that you understand it. If the work is new to you then you should outline the theory rather more fully citing the references from literature. Define here all the symbols corresponding to the variables and parameters of your problem. Describe in your own words what you did and why.

4. Results and Calculations

In general it is best to present your results in tabular form. If it is possible, present new data in addition to the derived results; this way, conversion errors will not completely invalidate the report. Accuracy and errors should always be stated.

Indicate the reservoir conditions, tabulate the data you are given and estimated, perform sample calculations, and plot graphs showing the calculated or interpreted results. Use comparisons wherever appropriate if you have done similar studies in different ways (e.g. experimental and numerically simulated data). Ensure that the domain and range of your graph is such that the data of interest take up the major portion of the graph. Give a title to each graph and properly label each curve on the graphs.

5. Analysis and Discussion

Indicate the assumptions you make for interpreting your results, explain and justify differences between results of different sources, indicate and explain any data behavior (trend) that is expected or not expected, calculate and explain errors, and provide advantages/disadvantages of the procedures used.

First, note any interesting observations on the raw results – trends, scatter, anomalies, etc. Then analyze the results in terms of the theory previously presented and discuss the outcome. Do not waste many words stating the obvious, but do your best to account for significant discrepancies. Try to do this specifically, if possible using numbers, and not by fuzzy arguments. Accuracy and errors should again be stated.

6. Conclusions

This section should not be a repetition of the cover letter/executive summary, but rather a summary of what was accomplished through the semester (do not give results) – text only, no numbers or figures. Indicate suggestions for improvements/further work.

The conclusions should be numbered and brief. In general you should not introduce new material in this section.

7. References

Author's name, Title of Publication, Journal Year, Volume, Page. Use SPE conventions.

General Comments

Report writing is an important aspect of the job of any engineer for accurately conveying the findings of a study. Your report should read smoothly and in the past tense, as you have prepared it for a client or your boss. Ensure proper spelling and grammar. Number the tables and figures and properly refer to them in the text. Use a 12 pt font size for uniformity.

Please note the following:

“CODE OF STUDENT BEHAVIOUR”, updated May 30, 2016

(<http://www.governance.ualberta.ca/CodesofConductandResidenceCommunityStandards/~media/Governance/Documents/Codes%20of%20Conduct%20and%20Residence%20Community%20Standards/Code%20of%20Student%20Behaviour/COSB-Updated-May-30-2016.pdf>)

“30.3.2 Inappropriate Academic Behaviour

30.3.2(1) Plagiarism

No Student shall submit the words, ideas, images or data of another person as the Student’s own in any academic writing, essay, thesis, project, assignment, presentation or poster in a course or program of study.

30.3.2(2) Cheating

30.3.2(2) a No Student shall in the course of an examination or other similar activity, obtain **or attempt to obtain** information from another Student or other unauthorized source, give or attempt to give information to another Student, or use, attempt to use or possess for the purposes of use any unauthorized material.

30.3.2(2) b No Student shall represent or attempt to represent him or herself as another or have or attempt to have himself or herself represented by another in the taking of an examination, preparation of a paper or other similar activity. See also misrepresentation in 30.3.6(4).

30.3.2(2) c No Student shall represent another’s substantial editorial or compositional assistance on an assignment as the Student’s own work.

30.3.2(2) d No Student shall submit in any course or program of study, without the written approval of the course Instructor, all or a substantial portion of any academic writing, essay, thesis, research report, project, assignment, presentation or poster for which credit has previously been obtained by the Student or which has been or is being submitted by the Student in another course or program of study in the University or elsewhere.

30.3.2(2) e No Student shall submit in any course or program of study any academic writing, essay, thesis, report, project, assignment, presentation or poster containing a statement of fact known by the Student to be false or a reference to a source the Student knows to contain fabricated claims (unless acknowledged by the Student), or a fabricated reference to a source.”

“30.3.4 Inappropriate Behaviour towards Individuals or Groups

30.3.4(1) Disruption

30.3.4(1) a No Student shall disrupt a Class in such a way that interferes with the normal process of the session or the learning of other Students.” **Comment: This includes use of laptops, phones and working on assignments distracting others**

Plagiarism and cheating

Plagiarism and cheating under the University of Alberta Code of Student Behaviour are defined in sections 30.3.2(1) and 30.3.2(2) as stated above.

Cheating can take many forms, such that it is possible to cheat without plagiarizing. However plagiarizing within the context of assignments, papers, lab reports, tests and examinations is also an attempt to take academic advantage over others in the same class; such that a better grade may be achieved. Taking academic advantage over others is hence also cheating. If you find yourself being suspected of plagiarism then it is likely that the Faculty of Engineering will also investigate you on a count of cheating simultaneously.