

Syllabus

PNGE 532: Reservoir Simulation & Modeling (Application of Geostatistics and Inverse theory)

West Virginia University, Fall 2015
Lecture: Monday 17:00-19:20 (ESB-E 501)

Instructor

Dr. Ebrahim Fathi 345D MRB
Office Hours: TR 13:00-14:00 or by appointment
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Prerequisites

Reservoir Engineering or consent

Course Objectives:

The principal objective of this course is the development of reservoir simulation theory to the level required for the construction of a three-phase, three-dimensional reservoir simulator. In addition to providing practice in developing a simulator, the course will also cover recent advances in simulation and history matching.

It is expected that at the end of the course the students will be familiar with techniques needed for the development of a three-phase, three-dimensional reservoir simulator.

The course will provide necessary engineering background in performing reservoir analysis via Numerical reservoir simulation.

Textbooks

- Principles of Applied Reservoir Simulation, J.R. Fanchi. Gulf, 2nd ed. 2001
- Practical Reservoir Simulation, M. Carlson. Penwell, 2003
- Computer Assisted Reservoir Management, A. Satter, J. Baldwin and R. Jespersen. Penwell, 2002
- Basic Applied Reservoir Simulation, T. Ertekin, J.H. Abou- Kassem and G.R. King. SPE Textbook Series Vol. 7, 2001
- RESERVOIR SIMULATION, Mattax, Calvin & Dalton, Robert, SPE vol.13, 1990 (*);
- PETROLEUM RESERVOIR SIMULATION, Aziz, Khalid, 1979 (*);
- MODERN RESERVOIR ENGINEERING: A SIMULATION APPROACH, Crichlow, Henry, 1977 (*);
- FUNDAMENTALS OF NUMERICAL RESERVOIR SIMULATION, Peaceman, Donald, 1977 (*);
- PRINCIPLES OF HYDROCARBON RESERVOIR SIMULATION, Thomas, G.W., 1982 (*);

Course Outline

The following course outline is subject to change, and the number of weeks spent on each topic is a rough estimate.

- Linear Algebraic Equations
- Curve fitting and interpolation
- Roots of equations
- Numerical differentiation and Integration
- Ordinary Differential equations IVP and BVP

- Partial Differential Equations PDE
- Conservation laws in equation form
- Development of multiphase flow equations under isothermal condition from Darcy's Law and Conservation of mass,
- Finite difference schemes for three-phase black oil simulation,
- Levels of implicitness from IMPES to simultaneous solution of fully implicit nonlinear finite difference equations with Newton-Raphson,
- Incorporation of well constraints including Peaceman type equations for relating gridblock pressures to flowing wellbore pressure,
- Simulation of Special Processes,
- Recent advances in reservoir simulation and history matching,

Details on the assignments will be given as we progress in the class. This schedule leaves one lecture session at the end of the semester for the overall discussion of the semester and the upcoming final exam.

Student Evaluation (Marking Scheme)

Homework Assignments 60%
 Projects 40%

Grade Assignment:

100 – 96	A+	95 – 90	A
89 – 87	A-	86 – 84	B+
83 – 80	B	79 – 77	B-
76 – 74	C+	73 – 70	C
69 – 65	C-	64 – 60	D
59 – 0	F		

Grading Questions:

Late Work: No late assignments will be accepted. The assignments are due at the **beginning** of regular lecture time, no exceptions.

Class Procedure

Attendance Policy: Consistent with WVU guidelines, students absent from regularly scheduled examinations because of authorized University activities will have the opportunity to take them at an alternate time. Make-up exams for absences due to any other reason will be at the discretion of the instructor.

More than three unauthorized absents results in %5 deduction from your final grade, if you miss more than 5 sessions you will lose %10 from your final grade and more than 7 unauthorized absents results in failing the course with grade F.

Texting or surfing (e.g. Facebook) in class is disrespectful and is therefore not allowed. All the cellphones must be on silent mode.

Social Justice Statement:

“The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (304-293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see <http://diversity.wvu.edu/>."

Academic Integrity

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

You also need to go to the <http://www.libraries.wvu.edu/instruction/plagiarism/> and pass the test and report your passing grade to the instructor.

Calculators may be allowed for use during the exams, depending on the material to be covered. Explicit guidance will be provided before the exam. In any case, use of electronic devices such as PDAs or programmable calculators for storing or communicating material that would not otherwise be available to you during the exam is strictly prohibited, and will result in a failing grade for the course and referral for academic discipline.