



PNGE 344 - Petroleum Reservoir Engineering II

2018/2019 Spring

Syllabus

Code 3740344 • **Prerequisite** 3740343

Time & Place Tuesdays, 08:40-11:30 • **Classroom** T-105

Instructor Dr. Emre Artun • **Office** T-138 • **Phone** 3014 • **e-mail** artun@metu.edu.tr

Office hours Wed. 15:40-17:30 or by appointment

Course Outcomes

After completing this course successfully, students will be able to:

1. apply appropriate analytical solutions for the flow of slightly-compressible fluids (single-phase) in porous media penetrated with a single-well, operated with a constant-rate, considering boundary conditions and flow regimes
2. apply analytical solutions for the flow of slightly-compressible fluids (single-phase) in porous media for multi-well, multi-rate situations using the superposition principle and image well theory
3. apply analytical solutions for the flow of slightly-compressible fluids (single-phase) in porous media for reservoir characterization from well-test measurements
4. apply quantitative immiscible-displacement theories for forecasting waterflooded reservoir performance and estimating relative permeability from displacement experiments

Catalog Content: Steady and unsteady state single phase flow equations through porous media, steady and unsteady superposition. Multiphase flow through porous media. Reservoir characterization in homogeneous and heterogeneous reservoirs by pressure and tracer testing.

Week	Topics & Exams	Relevant Reading/Activities
Chp.1	Fluid Flow in Porous Media	
Week 1	Introduction/Syllabus, fluid flow through porous media	Lee Ch.1, Dake Ch.5
Week 2	Diffusivity equation in radial coordinates, flow periods	Lee Ch.1, Dake Ch.5
Week 3	Non-dimensionalization of flow equations	Lee Ch.1, Dake Ch.5, PS-1
Week 4	Steady-state, pseudo-steady state, unsteady-state solutions	Lee Ch.1, Dake Ch.6-7
Week 5-6	Superposition principle: Multi-well/multi-rate problems	Lee Ch.1, Dake Ch.7
Week 7	Midterm Exam-1 tentatively on March 26	
Chp.2	Well Test Analysis	
Week 6-7	Introduction to well test analysis, pressure buildup testing	Lee Ch.2, Dake Ch.7
Week 8	Pressure drawdown testing, multi-rate tests	Lee Ch.2, Dake Ch.7
Week 9	Injection/fall-off tests, interference tests	Lee Ch.9-10, PS-2
Week 10	Reservoir boundaries/heterogeneities	Lee Ch.6-7
Week 11	Midterm Exam-2 tentatively on April 30	
Chp.3	Immiscible Displacement	
Week 12	Introduction to waterflooding and immiscible displacement	Dake Ch.10, Willhite Ch.3
Week 13	Buckley-Leverett, fractional flow equations, frontal advance theory	Dake Ch.10, Willhite Ch.3, PS-3
Week 14	Dykstra-Parsons method for layered reservoirs	

Textbooks

Lee, J., Rollins, J., Spivey, J. (2003). Pressure Transient Testing. SPE Textbook Series, Vol. 9, Richardson, Texas. (Chapters 1,2,4,9,10)

Dake, L.P. (1978). Fundamentals of Reservoir Engineering, Elsevier, Amsterdam. (e-book can be accessed via METU's Knovel subscription: <http://www.knovel.com/web/portal/main> (Chapters 5-7,10)

Willhite, G.P. (1986). Waterflooding. SPE Textbook Series, Vol. 3, Richardson, Texas. (Chapters 1,3)

Reference Books

Craft, B.C., Hawkins, M.F. (1959). Applied Petroleum Reservoir Engineering, Prentice Hall, New Jersey (Chapters 7,9).

Course Policies

Grading Policy

2 Midterm Exams: 52%

Final Examination: 36%

Problem Set Assignments: 12%

Attendance: Attendance will be taken to be used as a bonus/NA grade:

$$\text{Missed lecture hours exc. midterms, } n \left\{ \begin{array}{ll} \leq 5, & +2 \text{ bonus points added to final grade} \\ 5 < n \leq 10, & \text{no effect to the final grade} \\ 10 < n \leq 15, & -2 \text{ bonus points added to the final grade} \\ > 15, & \text{NA grade} \end{array} \right.$$

Final grading: If the class average for final grades is less than 69, curved grading is going to be utilized based on the overall grade distribution. Otherwise, the final grading will be based on the grade scale indicated in Article 24 of Academic Rules and Regulations for Undergraduate Education determined by the University which can be found in the following web page: <http://ncc.metu.edu.tr/ro/undergraduate-education-regulation>

Make-up exam: No make-up exam will be given unless an official excuse is submitted.

Class announcements: ODTUClass will be used regularly for postings and announcements with at least 24-hours notice. Therefore, students are responsible for checking for their ODTUClass/E-mail inbox everyday.

Homework problems: Homework problems will be individually-assigned and group work will not be allowed. While discussion with the instructor and classmates are encouraged, all of the work must be done individually. It is not allowed to use someone else's files or data at any step of the calculations. Copied work will be penalized with a 'zero' grade, and disciplinary action may be taken. Submissions must be as a hard-copy; please do not email excel files, homework documents unless requested.

Academic Integrity

Please note that PNGE 344 adopts METU NCC's Academic Code of Ethics. When a breach of the code of ethics occurs (cheating, plagiarism, deception, etc.) a faculty member has several (non-exclusive) options such as giving a *zero* grade for the relevant exam, project, assignment, and/or a larger part or all of the coursework, giving a failing letter grade for the course, or forwarding the case to the discipline committee. The METU NCC Academic Code of Ethics and its processes for dealing with academic integrity issues can be found at: <http://http://ncc.metu.edu.tr/res/academic-code-of-ethics>