

# Modeling Flow and Transport in Porous Media

## GEO 391, Fall 2015

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### Class details

Class room: EPS 1.126  
Class time: Tu/Th 2-3:30  
Unique: 27203  
Prerequisites: CHE 381P or PGE 381K (vector calculus, differential equations)  
GEO 325J or GEO 371C (Matlab)  
Description: This class will cover the modeling of basic dynamic phenomena that occur during single-phase flow and transport in porous media. The course will begin with a discussion of classic linear problems such as topography and well driven flows and advective-dispersive solute transport. Later we will analyze the nonlinear dynamics of gas flow, natural convection, and viscous fingering in porous media. The emphasis is on the mathematical modeling and analysis using analytic solutions, scaling analysis, self-similarity, boundary layers, and hydrodynamic stability. Throughout the course mathematical analysis and analytic solutions are compared with numerical solution of the governing equations, based on standard finite volume methods.

### Instructor

Instructor: Dr. Marc Hesse  
Office: EPS 3.152  
Office hours: Mon 4-5 pm (EPS 3.148)  
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html: <http://www.jsg.utexas.edu/hesse>

### Assessment

Grading: The class will be graded based on weekly homeworks.  
Collaboration: Homeworks can/should be discussed amongst students, but the solutions have to be written up individually.

### Course materials

No textbook is required

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# Syllabus

week	dates	lecture	topics	homework
1	27 Aug	1	Balance laws	
2	1, 3 Sep	2	Discrete operators	HW 1
3	8, 10 Sep	3, 4	Boundary conditions	HW 2
4	15, 17 Sep	5, 6	2D numerics	HW 3
5	22, 24 Sep	7, 8	Topographic flow, streamfunction	HW 4
6	29 Sep, 1 Oct	9, 10	Wells, Compressibility	HW 5
7	6, 8 Oct	11, 12	Transient flow	HW 6
8	13, 15 Oct	13, 14	Solute balance	HW 8
9	20, 22 Oct	15, 16	Scaling transport	...
	27-29 Oct	17, 18	Upwind flux, Coupled flow & Transport	...
10	3, 5 Nov	19, 20	Newton's method, gas flow	...
11	10, 12 Nov	21, 22	Richard's equation	...
12	17, 19 Nov	23, 24	Viscous fingering	...
13	24, 26 Nov		Thanksgiving break	...
14	1, 3 Dec	25, 26	buffer	...

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