Term Information

Effective Term	Autumn 2014
Previous Value	*Summer 2012*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Broaden course content to include other subsurface fluids of economic and societal importance (e.g., oil and gas); change course name to reflect change in content.

What is the rationale for the proposed change(s)?

The recent faculty hires in Earth Sciences, the increased student interest in the hydrocarbon industry, and the University's increased emphasis on the Discovery Theme of Energy and Environment all provide reasons to expand this course from its previous focus on groundwater flow to a broader consideration of fluid movement in the subsurface, including the migration of gas, oil, water, and mixed phases. No other course in Earth Sciences provides this overview, particularly in a quantitative form.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

No new program requirements; this course will be added to the list of electives in several of our B.S. subprograms, and will be an elective course for our graduate students.

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Earth Sciences
Fiscal Unit/Academic Org	School of Earth Sciences - D0656
College/Academic Group	Arts and Sciences
Level/Career	Graduate, Undergraduate
Course Number/Catalog	5751
Course Title	Quantitative Reservoir Modeling
Previous Value	*Quantitative Ground-Water Flow Modeling*
Transcript Abbreviation	QuantResModeling
Previous Value	*Quant GrndwtrModel*
Course Description	Principles of analytical and numerical techniques in modeling single- and multiphase flow in gas, oil, and water (aquifer) reservoirs. Development of Matlab code for two- and three-dimensional flow in porous media.
Previous Value	*Principles of analytical and numerical techniques in modeling ground-water flow in porous media, development of two- and three-dimensional steady-state and transient flow codes.*
Semester Credit Hours/Units	Fixed: 4

Offering Information

Length Of Course	14 Week, 7 Week
Flexibly Scheduled Course	Sometimes
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade

Repeatable	No
Course Components	Laboratory, Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Prereq: Math 1152 and Earth Sci 2245, or permission of instructor.
Previous Value	*Prereq: 5651 (EarthSci 651 or GeolSci 651).*
Exclusions	
Previous Value	Not open to students with credit for EarthSci 751 or GeolSci 751.

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0605
Subsidy Level	Doctoral Course
Intended Rank	Junior, Senior, Masters, Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Students understand the major variables that control fluid migration in the subsurface.
- Students can apply appropriate numerical methods to problems of subsurface fluid migration, and recognize the limitations of their solutions.
- Students can identify situations where numerical reservoir simulators are appropriate.

Previous Value

Content Topic List

- Model Equations for Immiscible and Compositional Multiphase Flow in Subsurface Porous Media
- Traditional and Advanced Numerical Methods
- Programming in Matlab
- Applications that Require Numerical Reservoir Simulators
- Challenges in Reservoir Simulations

Previous Value

- *Conceptual models*
- *Governing equations and continuity*
- *Finite difference approximations*
- *Boundary conditions*
- *Flow nets*
- *MODFLOW*
- *Transient models*
- *Solvers*
- *Calibration*
- *Advective contaminant transport*
- *Particle tracking*
- *Capture zone analysis*
- *Closed basin hydrology*
- *Density-dependent flow and transport*

Attachments

- 5751 course change_draft syllabus.docx: Draft syllabus

  (Syllabus. Owner: Krissek,Lawrence Alan)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Krissek,Lawrence Alan	01/07/2014 01:21 PM	Submitted for Approval
Approved	Krissek,Lawrence Alan	01/07/2014 01:21 PM	Unit Approval
Approved	Hadad,Christopher Martin	01/07/2014 04:04 PM	College Approval
Pending Approval	Vankeerbergen,Bernadette Chantal Nolen,Dawn Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole Hanlin,Deborah Kay	01/07/2014 04:04 PM	ASCCAO Approval

DRAFT SYLLABUS
Earth Sci 5751: Quantitative Reservoir Modeling

Instructor: TBA
Office: TBA
Phone: TBA

Lecture: TBA
Lab: TBA

Course description: This course will examine principles of analytical and numerical techniques in modeling single- and multiphase flow in gas, oil, and water (aquifer) reservoirs. Much of the course will involve development of Matlab code for two- and three-dimensional flow in porous media.

Course goals: Upon completing this course, students will:
1) understand the major variables that control fluid migration in the subsurface
2) identify situations where numerical reservoir simulators are appropriate
3) apply appropriate numerical methods to problems of subsurface fluid migration, and recognize the limitations of their solutions

Reading: TBA

Grading:
60% of the grade will be based on the development of a basic reservoir simulation code over the course of the semester. 15% of the grade will be based on pop quizzes, which require attendance, and 25% of the grade will be based on a final take-home test of the theoretical material.

Topics:

1) Model Equations for Immiscible and Compositional Multiphase Flow in Subsurface Porous Media:
    a. Darcy’s Law for Convective Flow
    b. Fickian Diffusion
    c. Capillary Driven Flow
    d. Pressure Equation from Volume Balance
    e. Phase Behavior, and Phase-Split Computations
2) Traditional and Advanced Numerical Methods:
    a. Finite Difference
    b. Finite Volume
    c. Finite Element
    d. Multipoint Flux Approximation
    e. Alternative methods
3) Programming in Matlab
4) Applications that Require Numerical Reservoir Simulators:
    a. Recovery of Energy Resources:
    b. Gravity Depletion
    c. Water Flooding
    d. Miscible and Immiscible Gas Injection

e. Water-Alternating-Gas Injection
f. CO_2 Capture and Sequestration
g. Groundwater Modeling and Contaminant Transport

5) Challenges in Reservoir Simulations
    a. Numerical Dispersion
    b. Grid Sensitivity
    c. Computational Efficiency
    d. Physical Instabilities, such as Viscous and Gravitational Fingering

Academic Misconduct Statement:
It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Student Disability Statement:

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/.