Texas A&M University

Departmental Request for a New Course
Undergraduate • Graduate • Professional

Submit original form and attach a course syllabus.

1. This request is submitted by the Department of Petroleum Engineering

2. Course prefix, number and complete title of course: PETE 637; Streamline Simulation

3. Course description (not more than 50 words): Introductory and advanced concepts in streamline simulation and its applications; theory of streamlines/streamtubes in multidimensions; topics include: streamline, streamtubes, streamfunctions, transport along streamlines, spatial discretization and material balance, time stepping and transverse fluxes, impact of cell geometry, history matching and production data integration, comparison with finite difference.

4. Prerequisite(s) Graduate classification

Cross-listed with

Cross-listed courses require the signature of both department heads.

5. Is this a variable credit course? ☐ Yes ☑ No If yes, from _______ to _______.

6. Is this a repeatable course? ☐ Yes ☑ No If yes, this course may be taken _______ times. Will the course be repeated within the same semester/term? ☐ Yes ☐ No

7. Has this course been taught as a 289/489/689? ☑ Yes ☐ No If yes, how many times? _______ Indicate the number of students enrolled for each academic period it was taught. 04C-17; 06C-9; 08A-11

8. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)

   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

   MS and PhD students in petroleum engineering or geosciences

9. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

10. Prefix | Course # | Title (excluding punctuation)
      PETE 637 | STREAMLINE SIMULATION

<table>
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<th>Lect.</th>
<th>Lab</th>
<th>SCH</th>
<th>Subject Matter Content Code</th>
<th>Admin. Unit</th>
<th>Acad. Year</th>
<th>FICE Code</th>
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Approval recommended by: ________________________________ 31 July 2008

Head of Department  Date  Chair, College Review Committee  Date

Head of Department (if cross-listed course)  Date  Dean of College  Date

Submitted to Coordinating Board by: ________________________________

Director of Academic Support Services  Date  Effective Date

Questions regarding this form should be directed to Sandra Williams at 845-8836.
OAR/AS – 04/07

1 of 4 B6
Texas A&M University — Department of Petroleum Engineering
Proposed Course Syllabus

Number and Name of Course: PETE 637 Streamline Simulation

Hours: Theory 3 Practice 0 Total 3 Credits 3

Prerequisites: Graduate Classification
Curricula Requiring this course: [x] None, this course will be an elective.

Description of Course: (Concise Statement of purpose of design)
This course is designed to cover introductory and advanced concepts in streamline simulation and its applications. The theory of streamlines/streamtubes in multidimensions is reviewed. The specific topics include: Streamline, Streamtubes, Streamfunctions. Transport Along Streamlines. Spatial Discretization and Material Balance. Time Stepping and Transverse Fluxes. Impact of Cell Geometry. History Matching and Production Data Integration. Comparison with Finite Difference.

Text Materials:
No Required Textbook.
Available from the Society of Petroleum Engineers. (http://store.spe.org/product.asp?p_id=1842&c_id=57)

Course Outline: (by major topics, and approximate time for each topic)

Introduction (1 Week)
- The Role of Streamline Simulation
- Historical Precedents
- Chronological development

Basic Governing Equations (1 Week)
- General Conservation Equations
- Pressure Equation
- Treatment of Sources and Sinks

Streamline, Streamtubes, Streamfunctions (2 Weeks)
- Streamfunctions & Complex Potential
- Streamtubes
- Streamlines & Time of Flight:
  - Transformation to the r-coordinate
  - Rectangular Cells: The Pollock Approach
- Compressible Flow
  - Pathline Construction
  - Diffusive time of flight

Transport Along Streamlines (1 Week)
- Analytical Solutions
- Semianalytic Solutions
  - Flexistream Approach
- Numerical Solutions
  - Lagrangian Approach
  - Eulerian Approach
  - Front Tracking

Spatial Discretization and Material Balance (1 Week)
- Saturation Interpolation
  - Cells to Lines,
  - Lines to Cells
- Wells
- Compressible Flow
- Streamline Updating: Unsteady State & Gravity:
  
  **Time Stepping and Transverse Fluxes (1 Weeks)**
  - Concepts of Operator Splitting
  - Modeling Gravity
  - Modeling Capillarity and Transverse Dispersion
  - Modeling fractured Reservoirs

  **Impact of Cell Geometry (2 Weeks)**
  - Corner-Point Extension
    - Faulted cells
    - Unstructured grids (triangles and tetrahedra)
  - Impact on Displacement Calculations

  **History Matching and Data Integration (2 Weeks)**
  - Assisted History Matching
  - Automatic History Matching
  - Streamlines and Asymptotic Ray Theory
  - Sensitivity Computations Using Streamline Models
  - Production Data Integration into High-Resolution Models

  **Field Studies 1: Basic (1 Week)**
  - Pattern Management (Bubble Plot/Flood Front Management)
  - Allocation Factors (Bundles)/Injector Efficiency
  - Swept Volume Calculations – Tracer Interpretation
  - Fast Runs: Speed up issues
  - Early Field Life Surveillance: Primary Depletion
  - Fractured Reservoirs: Explicit Fracture and Dual Porosity
  - Assisted History Matching
  - Understanding Reservoir Mechanisms

  **Field Studies 2: Advanced (2 Weeks)**
  - Flow Visualization/sector models
  - Fast Runs
  - Ranking and Uncertainty Assessment
  - Upgridding/grid design
  - Upscaling QC
  - Pseudoization
    - Generalized Dykstra-Parsons: Hewett and Yamada
    - Reformulation in time of flight coordinates
  - History Matching

**Course grading:**
- Midterm Exam ................................................................. (30%)
- Final Exam ...................................................................... (30%)
- Class Projects/Homeworks ......................................................... (40%)
- Total ............................................................................... (100%)

**Course Instructor/Supervisor:**
Dr. Akhil Datta-Gupta
Tel. (979) 847-9030
Office: Rm401G Richardson Building
e-mail: datta-gupta@tamu.edu

**Miscellaneous:**
- ABET Classification: Science: ______ Design: ______ Math: ______ Other: ______
- Laboratory Requirements: Yes: ____ No: ____ x
- Equipment Required: None
**ADA Policy Statement**: (Texas A&M University Policy Statement)

Americans with Disabilities Act (ADA) Policy Statement

The following ADA Policy Statement (part of the Policy on Individual Disabling Conditions) was submitted to the UCC by the Department of Student Life. The policy Statement was forwarded to the Faculty Senate for information.

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe that you have a disability requiring an accommodation, please contact Disability Services in Cain Hall, Room B118, or call 845-1637. For additional information visit [http://disability.tamu.edu](http://disability.tamu.edu)

**Coursework Copyright Statement**: (Texas A&M University Policy Statement)

Suggested for Inclusion in Your First Day Handout or Syllabus

The handouts used in this course are copyrighted. By "handouts," this means all materials generated for this class, which include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copy-righted, you do not have the right to copy them, unless you are expressly granted permission.

As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

If you have any questions about plagiarism and/or copying, please consult the latest issue of the *Texas A&M University Student Rules*, under the section "Scholastic Dishonesty."

**Academic Integrity Statement and Policy**

The Aggie Honor Code and the Honor Council Rules and Procedures can be found in [http://www.tamu.edu/aggiehonor](http://www.tamu.edu/aggiehonor)

"An Aggie does not lie, cheat or steal, or tolerate those who do"