MEEN 4800.001

Topics in Mechanical and Energy Engineering

Oil and Gas

Spring 2016

Course description: Overview of the petroleum industry and petroleum engineering including nature of oil and gas reservoirs, petroleum exploration and drilling, formation evaluation, completion and production, surface facilities, reservoir mechanics, and improved oil recovery. The course will also provide detailed discussion on fuels and refining processes.

Catalog Description: The course provides an overview and history of the oil and gas industry and petroleum engineering, including nature of oil and gas reservoirs, petroleum exploration and drilling, formation evaluation, well completions and production, surface facilities, reservoir mechanics, and improved oil recovery. It introduces the importance of ethical, societal, and environmental considerations and current events on activities in the petroleum industry.

Prerequisite(s): Consent of instructor.

Textbook: None. Reading materials and handouts will be provided.

Reference books:


Course objectives: Course objectives are: (1) to provide students with fundamental concepts associated with the oil and gas industry; (2) to introduce them to up-stream, mid-stream and down-stream activities via guest lectures by industry professionals; (3) to highlight key engineering problems and solutions relevant to the energy industry sector.

Learning outcomes:

1. Knowledge of the fundamental concepts of petroleum fuels
2. Ability to identify, formulate, and solve engineering problems
3. Knowledge of global and societal issues related to petroleum fuels and energy production
4. Knowledge of industrial practices in the oil and gas sector
5. Performing on a team-based project
Course content:

1. Introduction
   1.1. Historical Perspective
   1.2. Nature of Oil & Gas
   1.3. U.S. and Global Energy Production and Demand

2. Fuels
   2.1. Classification
   2.2. Energy Systems
   2.3. Stoichiometry and Thermodynamics

3. Geology
   3.1. Basic Geology
   3.2. Structural Geology
   3.3. Petroleum Geology

4. Petroleum Exploration
   4.1. Petroleum Exploration
   4.2. Tools and Techniques
   4.3. Mineral Rights and Leasing

5. Drilling
   5.1. Rotary Rig Basics
   5.2. Mud Systems
   5.3. Directional Drilling

6. Formation Evaluation
   6.1. Mud Logging
   6.2. Well Logging
   6.3. Drillstem Tests
   6.4. Core Analysis

7. Completions
   7.1. Casing Design
   7.2. Cementing
   7.3. Completion Techniques

8. Reservoir Engineering
   8.1. Material Balance
   8.2. Decline Curve Analysis
   8.3. Immiscible Displacement & Water-flooding
   8.4. EOR Techniques

9. Production Engineering
   9.1. Inflow Performance
   9.2. Well Stimulation Techniques
   9.3. Artificial Lift

10. Unconventional Sources
    10.1. Oil Sands
    10.2. Oil Shale
    10.3. Shale Gas (“Fracking”)
    10.4. Methane Hydrates

11. Transportation and Refining
    11.1. Transportation and Storage
    11.2. Refining and Processing
    11.3. Gas Processing
    11.4. Petrochemicals
12. Topical Issues
12.1. Petroleum Economics
12.2. Peak Oil Theories
12.3. Environmental, Health and Safety Concerns
12.4. Energy Options and Policy

Course format: 3 hours of lecture per week; Tue & Thur 4:00–5:20 p.m.

Office hours: Tue & Thur 2:00–4:00 p.m.

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeworks, quizzes, and other assignments</td>
<td>25%</td>
</tr>
<tr>
<td>Class project(s)</td>
<td>25%</td>
</tr>
<tr>
<td>Midterm exam</td>
<td>20%</td>
</tr>
<tr>
<td>Final exam</td>
<td>20%</td>
</tr>
<tr>
<td>Class participation</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Disabilities accommodation: The University of North Texas complies with Section 504 of the 1973 Rehabilitation Act and with the Americans with Disabilities Act of 1990. The University of North Texas provides academic adjustments and auxiliary aids to individuals with disabilities, as defined under the law. 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 you have a disability requiring accommodation, please see the instructor and/or contact the Office of Disability Accommodation at 940-565-4323 during the first week of class.

Instructor: Dr. Kuruvilla John
Professor and Associate Dean for Research and Graduate Studies
Department of Mechanical and Energy Engineering
College of Engineering
University of North Texas
Denton, Texas 76207
Kuruvilla.John@unt.edu
(940) 565-4302