



## **Course Syllabus**

### **SCIT 1270 – Petroleum Chemistry**

**Catalog Description:** Petroleum Chemistry

**Lecture hours = 1, Lab hours = 4**

**Prerequisites:** Introduction to Energy (ENER 1350)

**Semester Credit Hours:** 2

**Lecture Hours per Week:** 1

**Lab Hours per Week:** 4

**Extended hours:**

**Contact Hours per Semester:** 80

**State Approval Code:** 40.0504

**Class section meeting time:**

**Alternate Operations During Campus Closure:** In the event of an emergency or announced campus closure due to a natural disaster or pandemic, it may be necessary for Panola College to move to altered operations. During this time, Panola College may opt to continue delivery of instruction through methods that include, but are not limited to: online learning management system (CANVAS), online conferencing, email messaging, and/or an alternate schedule. It is the responsibility of the student to monitor Panola College's website ([www.panola.edu](http://www.panola.edu)) for instructions about continuing courses remotely, CANVAS for each class for course-specific communication, and Panola College email for important general information.

Students are expected to spend sufficient time each week reading, watching screencasts, reviewing, and participating in assigned activities outside of class time for successful completion of this course. (Study time not included) Additionally, students are expected to spend 3 hours per week in lab and working on lab related assignments.

**Instructional Goals and Purposes:** The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes.

### Learning Outcomes:

1. Understand factors that affect the choice of production chemicals including greener chemicals
2. Understand **the control of...** production chemicals for the oil & gas industry.... water and gas; scale; acid stimulation; sand; corrosion in production; gas hydrate; wax (paraffin wax); demulsifiers; foam; flocculants; biocides; hydrogen sulfide scavengers; oxygen scavengers; and drag-reducing agents.
3. Understand **hydrogen carbon...** terminology, definitions, classifications, properties and chemical composition and associated metals, and including natural gas properties
4. Understand the chemistry of the cementing process as it relates to casings and other applications
5. Understand the equipment and procedures for evaluating drilling fluid performance
6. Understand clay mineralogy and the colloid chemistry of drilling fluids
7. Understand hole stability, well logging and wire logging
8. Understand **chemical analysis associated with** natural gas processing: oil and gas separation, conversion and finishing which includes physical properties and analytical analysis... Understand the chemistry associated with natural gas processing and separation techniques. Also, discuss the ideal gas laws and their effect on processing and separation
9. Understand the chemistry of crude oil refining: distillation and separation; hydrogenation and dehydrogenation; thermal, hydro and catalytic cracking; isomerization and vis breaking

### Specific Course Objectives (includes SCANS):

After studying all materials and resources presented in the course, the student will be able to:

1. Understand factors that affect the choice of production chemicals including greener chemicals. (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Chemical injection
  - b. Where to inject
  - c. Other methods of chemical deployment
  - d. Designing greener chemicals
2. Understand **the control of** production chemicals for the oil & gas industry.... water and gas; scale; acid stimulation; sand; corrosion in production; gas hydrate; wax (paraffin wax); demulsifiers; foam; flocculants; biocides; hydrogen sulfide scavengers; oxygen scavengers; and drag-reducing agents. (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Definitions and Terminology
  - b. Chemicals used
  - c. Chemical methods and control strategies
3. Understand **hydrogen carbon...** terminology, definitions, classifications, properties and chemical composition and associated metals, and including natural gas properties (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Introduction and discussion
4. Understand the chemistry of the cementing process as it relates to casings and other applications (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Procedures
  - b. Composition and forms of cements
  - c. API cements
  - d. Additives
5. Understand the equipment and procedures for evaluating drilling fluid performance (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
  - a. Density, Viscosity, Gel Strength, Filtration
  - b. Particle size determination
  - c. Determination of Gas, Oil and Solids content

- d. Electrical properties
  - e. Foams and foaming agents rheological properties
  - f. Chemical analysis
6. Understand clay mineralogy and the colloid chemistry of drilling fluids (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
    - a. Clay swelling mechanisms
    - b. Flocculation
    - c. DE flocculation
  7. Understand hole stability, well logging and wire logging (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
    - a. The mechanics of borehole stability
    - b. Hole instability caused by interaction between the drilling fluid and shale formations
  8. Understand **chemical analysis associated with** natural gas processing: oil and gas separation, conversion and finishing which includes physical properties and analytical analysis... Understand the chemistry associated with natural gas processing and separation techniques. Also, discuss the ideal gas laws and their effect on processing and separation (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
    - a. Separation techniques
    - b. Hydrates
    - c. Conversion and finishing which includes physical properties and analytical analysis
    - d. The Chemistry associated with separation
    - e. The ideal gas laws and their effect on processing and separation
  9. Understand the chemistry of crude oil refining: distillation and separation; hydrogenation and dehydrogenation; thermal, hydro and catalytic cracking; isomerization and vis breaking (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
    - a. distillation and separation
    - b. Hydrogenation and dehydrogenation
    - c. Thermal, hydro and catalytic cracking
    - d. Isomerization
    - e. Vis-breaking

### **Course Content:**

Students in all sections of this course will be required to do the following:

1. Students will study assigned materials and complete quizzes and exams to assess understanding and comprehension.
2. Students will complete all lab assignments as scheduled and all students are required to wear Personal Protective Equipment (PPE) in the lab.

### **Methods of Instruction/Course Format/Delivery:**

Students in traditional, hybrid and Internet classes will have access to courses via Canvas. Students in the traditional class will meet regularly for lecture. Students in the Internet class will be required to take quizzes and exams at an approved testing facility or, they may also be administered by the instructor. Students in hybrid classes will have both in class and online assignments. Resources for this course, provided through Canvas, include the following Sections in Canvas....

- Modules: Chapter study materials, self-assessment exercises, quizzes and exams

- Announcements and Recent Activities List: Instructor Announcements
- Inbox: Email (to communicate with instructor and classmates inside Canvas)
- Grades: Student grades
- Other sections, as assigned by the Instructor: Students in both the traditional and Internet classes should use the People feature within Canvas (includes Canvas Email) to communicate with the instructor. Using Canvas Email located in the “In Box” menu, gives the student access to the instructor and other classmates without having to remember or type email addresses; the student just selects a name from the list. The instructor will attempt to respond to all Canvas email within 24 hours. For example, if a student makes an appointment with the instructor through Canvas email to take an exam, the instructor will reply to the student’s Canvas email – if the instructor does not reply within the time needed, call the instructor’s at his or her office. Please, always include in the subject line of the Canvas email, the student’s name, course number and course section number.

**Assessment:**

The following items will be assigned during the semester and used to calculate the student’s final grade:

**ATTENDANCE AND PARTICIPATION**

Students are expected to attend face to face classes and labs, and be on time. Students are also required to participate with other students during class exercises.

**QUIZZES**

After working through the chapter or chapters and completing the assignments, the student may take online or paper quizzes. Quizzes will generally contain True/False, Multiple Choice, Matching and/or Fill In-The-Blank questions and or other methods selected by the instructor.

**ASSIGNMENTS - LAB EXERCISES**

Students are provided with step-by-step instructions for completing each assignment. Assignments may include laboratory exercises, case studies, team-group assignments and other instructor assigned work. The student may be required to compile and turn in a notebook containing the completed performance sheets along with the student’s tabulated data or as otherwise directed by the instructor. Throughout the semester there will be lab exercises both virtual and hands on. Students will be assessed on his or her ability to complete the task with minimal assistance.

**EXAMS**

Multiple exams may be given during the semester with the final exam being cumulative in one or two parts, will assess the students various skills and may include lab exercises.

**Course Grade:**

The grading scale for this course is as follows:

- Assignments/Quizzes: 20%
- Labs: 30%
- Exams: 30%
- Final Exam: 20%

**Grading Notes:**

**Missed Exams:** Missed exams due to legitimate reasons should be taken prior to the reporting of mid-term or final grades as applicable. It is the responsibility of the student to reschedule the makeup with the instructor. The Instructor reserves the right to change the test format of any makeup. Instructors are not required to makeup work for an unexcused class absence. The Instructor also reserves the right to give full or partial credit for any makeup work that is allowed and that resulted from an unexcused absence.

**Missed Quizzes:** Missed quizzes due to legitimate reasons should be rescheduled within one week of the scheduled quiz or a date assigned by the Instructor. It is the responsibility of the student to reschedule makeup quizzes. The Instructor reserves the right to change the test format of the makeup quiz. Instructor is not required to makeup work for unexcused class absences. Instructor reserves the right to give full or partial credit for any make up work that is allowed and that resulted from an unexcused absence.

**Attendance:** Attendance is based on the student missing no more than 10% out of the semester without a valid excuse. After the 10% the instructor may withdraw the student at their discretion. Any student thirty or more minutes late will be counted absent. Students that leave before class is dismissed will be counted absent. The Instructor reserves the right to dock points for any missed class without a legitimate excuse.

**Missed Lab Exercises:** Students will have one day out of the semester assigned by the instructor to make up any lab exercises missed due to the student being absent for legitimate reasons. Instructors are not required to make up work for unexcused class absences. Instructors reserve the right to give full or partial credit for makeup work that is given because of unexcused absences.

**Plagiarism:** Plagiarism shall be defined as appropriating, buying, receiving as a gift or obtaining by any other means, another person's work and the unacknowledged submission or incorporation of it in one's own written work. All papers submitted to Canvas will be scanned with *turnitin.com* and the instructor reserves the right to dock points based on the results.

**Cheating:** Cheating on a test shall include:

- a. Copying from another student's test
- b. Using test materials not authorized by the person administering the test
- c. Collaborating with or seeking aid from another student during a test without permission from the test administrator
- d. Knowingly using, buying, selling, stealing, or soliciting, in whole or in part, the contents of an unadministered test.
- e. The unauthorized transporting or removal, in whole or in part, of the contents of the unadministered test.

f. Substituting for another student, or permitting another student to substitute for one's self, to take a test.

g. Bribing another person to obtain an unadministered test or information about an unadministered test Absolutely no cheating is tolerated.

h. If a student is observed cheating they will be sent home immediately counted absent and given a zero on the assignment they were cheating on.

**Safety:** All students are required in lab exercises to bring and wear the proper PPE as instructed by your instructor. Failure to do so will result in one warning; if a student continues to violate safety rules the student will be sent home and counted absent.

**Class Conduct:** All cell phones should be turned off in all classes. If you must receive a call notify your instructor and step out of the classroom. No cell phones are allowed during testing. No disruptive behavior is allowed in class; if a student is being disruptive as determined by the instructor one warning will be given. If behavior persists, students will be sent home and counted absent.

Grading Scale A=90-100, B=80-89, C=70-79, D=60-69, F=69 and below

#### **Texts, Materials, and Supplies:**

- **STUDENT TEXTBOOK** (Students are required to purchase this textbook) **Production Chemicals for the Oil & Gas Industry, 2<sup>nd</sup> Edition, CRC Press, Malcolm A. Kelland ISBN 9781439873793**
- **REFERENCE BOOK LOCATED IN THE PANOLA LIBRARY AT THE REFERENCE DESK:** *The Chemistry and Technology of Petroleum, by James G. Speight, Fourth Edition, 4th Edition., 2010*

#### **Other:**

- Courses conducted via video conferencing may be recorded and shared for instructional purposes by the instructor.
- For current texts and materials, use the following link to access bookstore listings: <https://www.panolacollegestore.com>
- For testing services, use the following link: <https://www.panola.edu/student-services/student-support/academic-testing-center>
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Charles C. Matthews Student Center or go to <https://www.panola.edu/student-services/student-support/disability-support-services> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook, *The Pathfinder*: <https://www.panola.edu/> (located at the bottom under students)

## SCANS CRITERIA

1) **Foundation skills are defined in three areas: basic skills, thinking skills, and personal qualities.**

a) **Basic Skills:** A worker must read, write, perform arithmetic and mathematical operations, listen, and speak effectively. These skills include:

- i) Reading: locate, understand, and interpret written information in prose and in documents such as manuals, graphs, and schedules.
- ii) Writing: communicate thoughts, ideas, information, and messages in writing, and create documents such as letters, directions, manuals, reports, graphs, and flow charts.
- iii) Arithmetic and Mathematical Operations: perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques.
- iv) Listening: receive, attend to, interpret, and respond to verbal messages and other cues.
- v) Speaking: Organize ideas and communicate orally.

b) **Thinking Skills:** A worker must think creatively, make decisions, solve problems, visualize, know how to learn, and reason effectively. These skills include:

- i) Creative Thinking: generate new ideas.
- ii) Decision Making: specify goals and constraints, generate alternatives, consider risks, and evaluate and choose the best alternative.
- iii) Problem Solving: recognize problems and devise and implement plan of action.
- iv) Visualize ("Seeing Things in the Mind's Eye"): organize and process symbols, pictures, graphs, objects, and other information.
- v) Knowing How to Learn: use efficient learning techniques to acquire and apply new knowledge and skills.
- vi) Reasoning: discover a rule or principle underlying the relationship between two or more objects and apply it when solving a problem.

c) **Personal Qualities:** A worker must display responsibility, self-esteem, sociability, self-management, integrity, and honesty.

- i) Responsibility: exert a high level of effort and persevere toward goal attainment.
- ii) Self-Esteem: believe in one's own self-worth and maintain a positive view of oneself.
- iii) Sociability: demonstrate understanding, friendliness, adaptability, empathy, and politeness in group settings.
- iv) Self-Management: assess oneself accurately, set personal goals, monitor progress, and exhibit self-control.
- v) Integrity and Honesty: choose ethical courses of action.

2) **Workplace competencies are defined in five areas: resources, interpersonal skills, information, systems, and technology.**

a) **Resources:** A worker must identify, organize, plan, and allocate resources effectively.

- i) Time: select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
- ii) Money: Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
- iii) Material and Facilities: Acquire, store, allocate, and use materials or space efficiently.

Examples: construct a decision time line chart; use computer software to plan a project; prepare a budget; conduct a cost/benefits analysis; design an RFP process; write a job description; develop a staffing plan.

- b) **Interpersonal Skills:** A worker must work with others effectively.
- i) Participate as a Member of a Team: contribute to group effort.
  - ii) Teach Others New Skills.
  - iii) Serve Clients/Customers: work to satisfy customer's expectations.
  - iv) Exercise Leadership: communicate ideas to justify position, persuade and convince others, responsibly challenge existing procedures and policies.
  - v) Negotiate: work toward agreements involving exchange of resources, resolve divergent interests.
  - vi) Work with Diversity: work well with men and women from diverse backgrounds.

Examples: collaborate with a group member to solve a problem; work through a group conflict situation, train a colleague; deal with a dissatisfied customer in person; select and use appropriate leadership styles; use effective delegation techniques; conduct an individual or team negotiation; demonstrate an understanding of how people from different cultural backgrounds might behave in various situations.

- c) **Information:** A worker must be able to acquire and use information.
- i) Acquire and Evaluate Information.
  - ii) Organize and Maintain Information.
  - iii) Interpret and Communicate Information.
  - iv) Use Computers to Process Information.

Examples: research and collect data from various sources; develop a form to collect data; develop an inventory record-keeping system; produce a report using graphics; make an oral presentation using various media; use on-line computer data bases to research a report; use a computer spreadsheet to develop a budget.

- d) **Systems:** A worker must understand complex interrelationships.
- i) Understand Systems: know how social, organizational, and technological systems work and operate effectively with them.
  - ii) Monitor and Correct Performance: distinguish trends, predict impacts on system operations, diagnose deviations in systems' performance and correct malfunctions.
  - iii) Improve or Design Systems: suggest modifications to existing systems and develop new or alternative systems to improve performance.

Examples: draw and interpret an organizational chart; develop a monitoring process; choose a situation needing improvement, break it down, examine it, propose an improvement, and implement it.

- e) **Technology:** A worker must be able to work with a variety of technologies.
- i) Select Technology: choose procedures, tools or equipment including computers and related technologies.
  - ii) Apply Technologies to Task: understand overall intent and proper procedures for setup and operation of equipment.
  - iii) Maintain and Troubleshoot Equipment: Prevent, identify, or solve problems with equipment, including computers and other technologies.

Examples: read equipment descriptions and technical specifications to select equipment to meet needs; set up and assemble appropriate equipment from instructions; read and follow directions for troubleshooting and repairing equipment.



