Department of Chemistry

College of Education

University of Salahaddin

Subject: Petroleum Chemistry

Course Book: (Year 4)

Lecturer's name: Essa Ismaeil Ahmed

Azad Sdeeq Sadradin, Dler Dlshad Ghaffur

Darya Jalil Raheem and Cheman Dilshad

Academic Year: 2024/2025

1st Semester

Course Book

1. Course name	**Petroleum chemistry**
2. Lecturer in charge	**Essa Ismaeil Ahmed + Azad Sdiq sadraddin+ Dler Dlshad Ghaffur + Darya Jalil Raheem +Cheman Dilshad**
3. Department/ College	**Chemistry/College of Education**
4. Contact	**e-mail : essa.ahmed@su.edu.krd** **Tel: (07504880190)** **(07803751092)**
5. Time (in hours) per week	**Theory: 2** **Practical: 2**
6. Office hours	**6 hours**
7. Course code	**.....**
8. Teacher's academic profile	▪ **BSc in chemistry (2002)** **The University of Salahaddin - Erbil- Iraq** ▪ **MSc in Industrial chemistry/petroleum (2008)** **The University of Salahaddin - Erbil- Iraq** ▪ **PhD in petroleum and lubricant chemistry (2015)** **The University of Leicester- Leicester-UK**
9. Keywords	**Crude oil (petroleum), physical properties, oil refining, physical processes, fractionation, solvent extraction, , solvent dewaxing, solvent deasphalting, chemical processes, thermal cracking, catalytic cracking, catalytic reforming, alkylation, petroleum product specifications, …etc.**

10. Course overview:

Petroleum chemistry is a module which concerned about delivering the fundamental knowledge and skills related to petroleum industry, which are necessary for chemists graduating from the chemistry department at the college of education to know. The course covers an introduction to the importance of fossil fuels from which oil is one, history and importance of crude oil, what is the chemical constitutions of crude oil and oil products, and why the composition is different from oilfield to oilfield and even from well to well from the same field. Physical and chemical analysis of crude oil and petroleum products using various techniques and equipment available in chemistry department. The module also covers the fundamentals of petroleum processing including physical and chemical processes which are used during the course of oil refining. Finally, the course finalized by description of oil products in terms of physical and chemical characterization, followed by the process of blending and additive inclusion.

11. Course objective:

The course of petroleum is designed to deliver the fundamental skills, knowledge and different tools of learning which are necessary for chemists to know while they are graduating from the chemistry department in order to be able to work in academic institutes and industries professionally after their graduation. The course designed to make undergraduate students as a high school teacher, researcher, productive activities,

lab works, and in the way of engaging with different techniques in order to make them be equipped with the skills and literacies necessary for successful learning.

12. Student's obligation

Attending all lectures and practical experiments are crucial for students to do because all messages which has been designed to be delivered to improve the knowledge and skills are interpreted in class times and lab woks.

Additionally, it is recommended to practice the following tips:

Punctuality: arrive on time, pack up and leave on time.

Respect: speak respectfully, listen respectfully.

Responsibility: be prepared for classes—do the required activities and reading.

Academic Honesty: contribute original work—plagiarism is not acceptable.

Participate: acknowledge and welcome diversity – be prepared to receive and give feedback and don't be afraid to ask for help.

13. Forms of teaching

To engage our students in active learning, that reflect on what is advised in teaching undergraduate subjects, the following strategies are practiced;

Building appropriate relationships with students through learning their names, respecting and acknowledging diversity in the classroom and responding to questions in a supportive manner.

Using a range of teaching strategies to support different learning preferences and student diversity and build student independence.

Using teaching techniques that ensure that all students can contribute to and learn from classroom learning experiences.

Practicing feedback to show students how they can improve their learning, through classroom interactions.

Using a range of resources to support classroom activity, including but not limited to books, videos, handouts, white and black boards, online resources, room layout and other people. This accompanied by understanding the role of both online and face-to-face experiences in supporting student learning to explain the subject in more details.

14. Assessment scheme

The final degree (100%) will be based on the following assessments

Mid-term exam (10%)

Activities, homework's and quizzes (5%)

Attendance: Attending all classes and laboratory sessions is of crucial student obligation and will be taken class period. One (1) unexcused absence will not count against your overall attendance grade. If you know you will be absent ahead of time, it is your responsibility to make arrangements in advance to cover the material you will miss. Attendance will be count with an extra 2 scores for whom attended 100%.

Practical part includes monthly exams, report writing, quizzes, and activities (35%)

Final comprehensive theoretical exam counts (50%)

15. Student learning outcome:

At the end of this course students should know and understand the aims and terminologies related to crude oil, oil and oil product analysis, fractionation, petroleum processing, chemical composition, and physical properties of petroleum and its products

Learning communication skills including oral skills (listening and speaking effectively concerning oil industry)

Written skills such as (writing official letters regarding crude oil assays)
Problem solving and critical thinking regarding theoretical calculations for estimation of oil properties
Dealing with information in all formats (information competency) by learning students all skills necessary to discover, use, evaluate and communicate all information regarding petroleum chemistry and technology
Interpersonal abilities which include group leading or work co-operative in oil processing.

16. Course Reading List and References پێویست

1. M. R. Riazi, (2005), Characterization and properties of petroleum fractions.
2. James G. Speight, (2014), The chemistry and technology of petroleum 5th ed.
3. Ram Prasad, (2000), Petroleum refining technology 1st ed.
4. M. R. Riazi, (2013), Petroleum refining and natural gas processing.
5. ,Peter R. Pujado´ and Steven A. Treese, (2015), Handbook of Petroleum Processing 2nd ed
6. James H. Gary, (2007), Petroleum refining technology and economics, 5th ed.,

17. The Topics:	Lecturer name
First part of the subject	Essa Ismaeil Ahmed, duration: (2 hrs) 8/09/2024 to 00/12/2024
• Importance of fuels, introduction to petroleum, history of petroleum industry, formation theories	
• Chemical constitution of petroleum	
• SARA Analysis • Classification methods of crude oil	
• Properties of petroleum and petroleum products, and crude oil assays-1	
• Properties of petroleum and petroleum products, and crude oil assays-2	
• First monthly examination	
• Introduction to petroleum refining • Pre-treatments (Desalting and dewatering)	
• Atmospheric distillation, vacuum distillation, • Light naphtha Isomerization	
• Heavy naphtha reforming, • Alkylation and Polymerization,	
• Fluid catalytic cracking (FCC) and hydrocracking	
• Thermal cracking, coking and visebreaking,	
• propane deasphalting, solvent extraction, and Solvent dewaxing	
• Petroleum product Specifications, Gasoline, octane number, kerosene/ (jet fuels), gasoil, cetane number	
18. Practical Topics	Lecturer's name
Week 1: Evaluation of petroleum and its products by Distillation, boiling point, refining principles, evaporation. **Week 2:** Normal paraffin separation, hydrocarbon types present in	Essa Ismaeil Ahmed, Azad Sediq Barzinjy, Dler Dlshad Ghaffur,

petroleum, urea adduction principles. **Week 3:** Separation of aromatic and non-aromatic compounds from the high boiling point oils using liquid - solid chromatography, chromatographic principles, solubility. **Week 4:** Determination of molecular weight of petroleum using viscosity method, viscosity types, viscosity index. **Week 5:** Analysis of compound group of petroleum using (n-d-M) method, refractive index, density, molecular weight. **Week6:** Determination of water content of petroleum and petroleum products, dean-stark apparatus, **Week 7:** Determination of specific gravity of petroleum and petroleum Products using pycnometer method, gravity, API degree. **Week8:** Determination of Aniline point and Diesel index, aromatic content, cetane number **Week9:** Flash Point by Cleveland Open Cup, flammability. **Week10:** Pour point test of petroleum products, lubricant utility environment. **Week11:** Octane number measurement, RON & MON. **Week12:** Carbon Residue and Ash Content Determination Carbon Residue, petroleum composition.	Darya Jalil Raheem, and Cheman Dilshad Duration:(2 hrs) 8/09/2024 to 00/12/2024

19. Examinations:

1. ***Compositional:*** Describe, define or explain how petroleum is fractionated, then what are main products from refining?
2. Crude oil is refined by a process called fractionation or distillation. The word refining means 'removing impurities or unwanted substances'. The various constituents are separated in a fractionating column. The process starts by heating the crude oil and then collecting the different gas and vapour fractions as they condense at different levels in the column, with the heavier fractions being taken off at the bottom. The process is improved by reflux, that is, feeding some of the light liquids back down the column, to give more efficient separation.
3. *Describe* thermal cracking processes and draw the simplified flow-sheet of visebreaking process? What are advantages of this kind of units?
4. *What is the difference between resins and asphaltenes?*
5. *Wi*ll crude oils in two wells in the same field have the same API gravity? What about in the same reservoir? Does crude gravity from a reservoir change over time?
6. Why is mercaptan sulfur, H2S, and sulfur content in cuts important?
7. Where does the sulfur in crude oil come from?
8. What is the primary parameter used to describe the quality of crude oil? Why?
9. What is the impact on a crude oils specific gravity and viscosity if exposed to water washing or biodegradation?
10. What are two differences between the sulfur and nitrogen content of crude oil?
11. Which crude oil will have a lower pour point: a waxy crude or an aromatic–intermediate oil?

2. True or false type of exams:

Existing of aromatic hydrocarbons in gasoline improves its octane number.

a) True (T) b) False (F)

3. Multiple choices:

Dewaxing is a process by which wax content is reduced in mineral oil in order to enhance its ……..

12. Flash point **b)** Pour point **c)** Cetane number

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review **پێداچوونەوەی هاوەڵ**