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| Course Title | Chemistry of Hydrocarbons (Specialization in Oil & Gas Engineering) | | | | |
| Course Code | OG100 | | | | |
| Course Type | Compulsory | | | | |
| Level | B.Sc (Level 1) | | | | |
| Year/ Semester | 1st Year / 2nd Semester (Spring) | | | | |
| Teacher's Name | Prof. Christodoulos N. Christodoulou | | | | |
| ECTS | 5 | Lectures / week | 3 | Laboratories/week | 0 |
| Course Purpose | The purpose of the course is to introduce to the Oil & Gas engineering students organic chemistry and specifically the chemistry of hydrocarbons. In order to do that it is important to start with the possible hybridization of carbon atom and its bonding to hydrogen and other organic groups and name them To explain them how oil, Coal and Natural Gas were originally formed through the years and teach them how to extract useful products such as diesel and gasoline from crude oil distillation. Also, to teach them about the different hydrocarbon reactions and how many useful petrochemicals is possible to be produced. The students will also be able to perform useful mass balance calculations around a refinery and get familiar with useful products such as Methane, LPG, Methanol, Ammonia and Plastics. | | | | |
| Learning Outcomes | 1. Describe the bonding of Carbon in organic compound and draw their structure<br>2. Explain and comprehend what Hydrocarbons are and recognize the different types of hydrocarbons<br>3. Describe and do calculations using the weight% composition of organic compounds, determine Empirical and Molecular formulas<br>4. Determine the composition of a Natural Gas in Methane, Ethane and other constituents<br>5. Describe the processes involved in the formation of Oil, Coal and natural gas and their uses<br>6. Describe the chemical reactions of different hydrocarbons to produce other products such as Hydrogen, Methanol, Ethylene, Ammonia and other petrochemicals<br>7. Learn to write specific alkene reaction with KMnO4, KMnO4 + NaIO4 and ozonolysis reactions | | | | |

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| | 8. Explain the steps involved in the refining of oil as well as the use of fractional distillation products such as residuals, heavy fuel, diesel, naphtha, gasoline, LPG and light hydrocarbons (Methane, Ethane, etc). Relation of API and relative density of petroleum products<br>9. Understand the production of synthetic polymers and other industrial products of the petrochemical industry and perform mass balance calculations around a refining column | | |
| Prerequisites | None | Corequisites | None |
| Course Content | • Introduction (organic, inorganic materials)<br>• Atomic Orbitals – Hybrid Orbitals<br>• Hydrocarbons (Aliphatic, Aromatic, Naming of Hydrocarbons)<br>• Detection of C, H, N, S in organic compounds<br>• Weight% composition of organic compounds, Empirical formula, Molecular formula<br>• Properties and chemical reactions of hydrocarbons. Part 1: Aliphatic Hydrocarbons, Aromatic Hydrocarbons), etc<br>• Properties and chemical reactions of hydrocarbons. Part 2: Hydrogenation, Halogenation, Oxidation Reactions, etc<br>• Properties and chemical reactions of hydrocarbons. Part 3: Hydrocarbon cracking and polymerization Reactions, Production of Hydrogen, Methanol, Ammonia, Ethylene, Natural Gas to Liquid (GTL) fuels and other products<br>• Origin and formation of oil, coal and natural gas<br>• Classification of petroleum and crude oil refinery processes<br>• Fractional distillation and composition of crude oil<br>• Petrochemical industry and polymers<br>• Synthetic polymers and polymerization processes | | |
| Teaching Methodology | Power Point Presentation of Lectures, Videos, Questions, Discussion<br>Explanations with examples, Reviews, Quizzes | | |

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| | • Lectures for chemistry of hydrocarbons<br>• Explaining with specific examples different aspects of hydrocarbon reactions and solve specific problems<br>• Frequent short quizzes (about 8) on previous class lecture in order to enforce the “every day” studying and prepare the students to readily attend the next class lecture<br>• Tutorials, where the students ask further questions on the lectures for better comprehension<br>• Frequent reviews and discussions |
| Bibliography | **Suggested Textbook:**<br>Morrison R.T and Boyd R. N., “Organic Chemistry” Prentice Hall, Sixth Edition, 1992<br>Leffler W. L., “Petroleum Refining in a Non Technical Language”, PennWell, Fourth Edition 2008<br>Atkins R.C and Carey F.A, “Organic Chemistry; a brief course”, 3rd edition 2002<br>**Reference Books:**<br>Petroleum production systems. Economides M. et al |
| Assessment | • Quizzes: 20%<br>• Mid-term Exam: 20%<br>• Final Exam: 60% |
| Language | English |