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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF INFORMATION SCIENCE

SUMMER TERM END TERM EXAMINATION - August 2024

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| **Semester :** | **Date : 05.08.2024** |
| **Course Code : PET2011** | **Time : 1:00 PM to 4:00 PM** |
| **Course Name** : Oil and Gas Downstream Operations | **Max Marks : 100** |
| **Program : B.Tech** | **Weightage : 50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 2M=10M** | | | |
| 1 | State Octane number. | (CO1) | [Knowledge] |
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| 2 | State different units present in a petroleum refinery. | (CO1) | [Knowledge] |
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| 3 | Mention the types of crude oil based on its physical properties. | (CO2) | [Knowledge] |
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| 4 | Define the term distillation. | (CO2) | [Knowledge] |
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| 5 | Identify two derivatives of ethylene oxide. | (CO3) | [Knowledge] |
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| 6 | Define TAN. | (CO3) | [Knowledge] |
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| 7 | Define "heterogeneous hydrocarbon" | (CO4) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 8 | “Naphtha is a flammable liquid hydrocarbon mixture. Generally, it is a fraction of crude oil, but it can also be produced from natural gas condensates”. Based on the quoted statement explain the production process of Naphtha from natural gas. Also discuss few uses of naphtha in daily life. | (CO1) | [Comprehension] |
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| 9 | Elucidate the terms “recuperator,” “regenerator,” and “contact heat exchanger.” | (CO2) | [Comprehension] |
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| 10 | Describe the various elements of construction of a pipe-still heater. | (CO2) | [Comprehension] |
| 11 | Explain the importance of reactors in the Petrochemical industry for various chemical processes. | (CO3) | [Comprehension] |
| 12 | .http://guqbms.inpods.com:57953/api/v1/downloadFile?fileId=40841&tenantid=13  The above figure indicates a sample differential distillation unit, where L mol of crude contains L1 mol n-pentane and L2 mol n-hexane is distilled under differential conditions at 101.3 kPa until Y mol is distilled. Based on the above figure and statement determine average vapor mol fraction | (CO3) | [Comprehension] |
| 13 | Describe the physical properties of LPG in detail, ensuring to explain their significance and how they affect its usage and handling. | (CO4) | [Comprehension] |
| 14 | Summarize and explain the key physical properties of jet fuel, including its composition, density, flash point, freezing point, and energy content, to demonstrate a thorough understanding of its characteristics and their implications for aviation use. | (CO4) | [Comprehension] |

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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 20M=40M** | | | |
| 15 | A constant density first order reaction Crude to Gasoline is carried out in a constant volume batch reactor. The data obtained in the given table- http://guqbms.inpods.com:57953/api/v1/downloadFile?fileId=34650&tenantid=13 If the initial concentration of crude is 5 kmol/l, calculate the rate constant for the above reaction. Also, determine the time required for 50% conversion from crude to Gasoline. | (CO1) | [Application] |
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| 16 | In a 1-1 Counter flow shell and tube heat exchanger, a process stream of naphtha (Cp=2.192KJ/Kg.K) is cooled from 450K to 350K using water (Cp=4.2KJ/Kg.K) at 300K. The process stream flows on the shell side at a rate of 1Kg/sec and naphtha on the tube side at a rate of 5kg/sec. If the heat transfer coefficient (U) is 600W/m^2.K, determine the required heat transfer area (A). | (CO2) | [Application] |
| 17 | A mixture of 200 mol crude containing 150mol% diesel and 50 mol % light naptha is distilled under differential conditions at 101.3 KPa until 60 mol is distilled. If the distilled liquid mol fraction is 0.276. Determine average vapor mol fraction. | (CO3) | [Application] |